July 2021

Binder 111, Isoparorchiidae A-Z [Trematoda Taxon Notebooks]

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ISOPARORCHIIDAE Poche, 1926

Family diagnosis. — Large distomes. Oral sucker, pharynx and acetabulum well developed. Ceca long, serpentine. Testes postacetabular, symmetrical, in anterior half of body. Hermaphroditic sac enclosing distended end of ductus ejaculatorius, metraterm and hermaphroditic duct. Genital pore median, between two suckers. Ovary tubular, slender, posterior. Vitellaria dendritic, at posterior extremity. Uterus winding from side to side in hindbody. Excretory vesicle Y-shaped. Parasites of fishes. Including only one genus, *Isoparorchis* Southwell, 1913.

Isoparorchis Southwell, 1913

Syn. *Leptolecithum* Kobayashi, 1915

Generic diagnosis. — **Isoparorchiidae: Body very large, foliate and** transversely extended, unarmed, with margins turned over ventrally. Oral sucker subterminal, surmounted by preoral lobe. Pharynx contiguous with oral sucker. Esophagus very short. Ceca with "stomach" portion at commencement, running sinuously to posterior extremity. Acetabulum in anterior half of body. Testes posterolateral to acetabulum. Vesicula seminalis tubular, convoluted anterior or anterodorsal to acetabulum. Hermaphroditic sac pre-acetabular. Genital pore behind intestinal bifurcation. Ovary winding, submedian, near posterior extremity. Vitellaria median, immediately behind ovary, consisting of several subdivided branches overreaching ceca laterally. Laurer's canal forming receptaculum seminis at its origin. Uterus dorsal, forming transverse loops across ceca; metraterm well differentiated, penetrating hermaphroditic sac. Excretory stem sigmoid, dilated posteriorly; arms serpentine, united dorsal to pharynx. Parasitic in air bladder of freshwater fishes.

Genotype: *I. hypselobagri* (Billet, 1898), syn. *I. trisimilitubis* Southwell, 1913; *Leptolecithum eurytremum* Kobayashi, 1915; *I. tandani* Johnston, 1927 (Pl. 20, Fig. 251), in *Wallago attu*, *Tandanus tandanus*; Australia.

Immature forms in flesh of *Barbus tor* of Australia, in body cavity of *Wallago attu* of Java and encysted on surface of ovary, kidney etc. of *Macrones nemurus* — Bovien (1927). Adult in *Parasilurus asotus* and *Pseudobagrus aurantiacus* of Japan, immature forms in *Hypomesus olidus* and *Richardsonius balteatus* — Kobayashi, also in *Mogurnda obscura* from Lake Ogura, *Gnathopogon e. elongatus* and *Chaenogobius macrognathus* from Lake Suwa, and *Leuciscus balteatus* and *Sarcocheilichthys variegatus* from Kasumigaura, Japan. When introduced into the definitive host the larva penetrates the intestinal wall and wanders about till it finds its way into the air bladder — Yamaguti (1934). Immature forms were also found in *Ophiocephalus striatus* by Southwell (1913) and Bhalerao (1932). For additional larval hosts see Bhalerao (1936), Zmeev (1936), Wu (1938).

Hemiuridae

Subfamily Isoparorchinae Johnston,1927

Hemiuridae; body weakly muscular; posterior region not telescopic; testes preovarian, near acetabulum; ovary posttesticular; vitellaria dendritic, postovarian; uterus preovarian.

Type genus ISOPARORCHIS Southwell,1913 [illegible].

Isoparorchis, gen. nov. Southwell, 1913

Leaf-like and translucent worms, longer than broad. Oral and ventral suckers present, the latter being near the anterior extremity. Genital aperture almost midway between the two suckers. Each intestinal ramus in the form of a continuous letter **S** extending to the posterior margin of the worm. Testes in front of germarium, paired and globular, anterior, one on each side and very slightly posterior to ventral sucker. Vitelline glands dendritic and posterior. Germarium single, tubular and posterior. Uterus single, very long, disposed along the laterally directed loops of each ramus of the intestines, passing from one loop on one side to a loop on the other side alternately, across the body of the worm, to a point near the ventral sucker. It then runs straight in the median line to the genital aperture. Shell gland minute, situated at the junction of the uterus with the duct of the vitelline glands. Excretory pore terminal, median and posterior. Vesicle of varying size.

Excretory vessel bifurcating into two lateral branches a little anterior to vesicle, each branch running approximately parallel to the intestinal ramus on its own side. Parasitic in fishes.

Kobayashi, 1921

(17) Leptolecithum eurytremum n. g., n. sp. (Pl. XXVI, fig. 1).

Leptolecithum n. g. Kobayashi, 1921

Diagnosis. Hemiuridae. Body moderately large, flat; widest at posterior third. Both suckers well developed; ventral sucker at anterior third of body length. Glandular stomach well developed; intestinal caeca with several lateral windings and terminating blindly near the posterior end. Stem of the excretory vesicle bifurcates near the middle of the body and both arms extend almost to the pharynx; stem and arms both make several lateral windings. Testes lie symmetrically, immediately posterior to the ventral sucker. Vesicula seminalis a convoluted canal lying anterior to the ventral sucker. Ovary vermicular in form, lying transversely near the posterior end of the body and forming a large loop. Vitellaria consist of several long branches, which are again subdivided. Laurer's canal present; receptaculum seminis absent. Uterus very long, forming several convolutions between the two intestinal caeca. Eggs fairly large, numerous. Habitat: in the air-bladder of fishes.

Type species: *L. eurytremum* n. sp. Kobayashi, 1921

Hemiurioidea
Isoparorchidae Poche, 1926

ISOPARORCHIS Southwell, 1913

(diagnosis as emended by Wu, 1938)

Body somewhat elliptical, flattened dorso-ventrally. Cuticle aspinose. Oral sucker subterminal; ventral sucker at end of first third of body length. Prepharynx absent; pharynx well developed; esophagus almost indistinguishable. Glandular stomach very distinct; intestinal ceca of several windings extending to near posterior end of body. Testes 2, symmetrically located adjacent tto posterior margin of ventral sucker. Seminal vesicle convoluted, free in parenchyma, preacetabular. Sinus sac very muscular containing both male and female ducts (genital sinus). Genital pore between suckers. Ovary band-like lying transversely. Seminal receptacle and Laurer's canal present. Vitellaria dendritic, near posterior extremity. Excretory vesicle Y-shaped, pore terminal. Eggs small and numerous. Uterus long, convoluting, slightly extended beyond intestinal ceca.

Type species: I. hypselobagri (Billet, 1898) Odhner, 1927

Synonyms: I. trisimilitubis Southwell, 1913
Leptolecithum eurytremum Kobayashi, ~~1920~~ 1915
I. tandani Johnston, 1927

Notes: Bhalerao (1927) definitely placed Leptolecithum Kobayashi, 1920 as a synonym of this genus.

Chandler (1926) and Faust (1929) pointed out that this trematode can occur in man and Wu (1938) states that it has often been mistaken for Fasciolopsis buskii. It is doubtfull if the trematode actually establishes itself in the human intestine. It is ingested with fish.

Kobayshi (1920) thought the cercaria of this trematode was a cystophorous cercaria from Melania. Faust though Cercaria syringicauda from Melania obenina Brot. was the larva. These views may be correct but the cycle has not been demonstrated as yet.

ISOPARORCHIS Southwell

Synonym: Leptolecithum Kobayashi

Southwell's description: Leaf-like and transluent worms, longer than broad. Oral and ventral suckers present, the latter being near the anterior extremity. Genital aperture almost midway between the two suckers. Each intestinal ramus in the form of a continuous letter S extending to the posterior margin of the worm. Testes in front of germarium, apired and globular, anterior one on each side and veryb slightly posterior to ventral sucker. Vitelline glands dendritic and posterior. Germarium single, tubular and posterior. Uterus single, very long, disposed along the laterally directed loops of each ramus of the intestine passing from one loop on one side to a loop on the other side alternately, across the body of the worm, to a point near the ventral sucker. It then runs straight in the median line to the genital aperture. Shell gland minute, situated at the junction of the uterus with the duct of the vitelline glands. Excretory pore terminal, median, and posterior. Vesicle of varying size. Excretory vessel bifurcating into two lateral branches a litlle anterior to vesicle, each branch running approximately parallel to the intestinal ramus on its own side. Parasitic in fishes.

Kobayshi's description: Hemiuridae. Body moderately large, flat; widest at posterior third. Both suckers well developed; intestinal ceca with several lateral windings and terminating blindly near the posterior end; glandular stomach well developed. Ventral sucker at anterior third of body. Stem of excretory vesicle bifurcates near the middle of the body and both arms extend nearly to the pharynx; stem and arms both make several lateral windings. Testes lie symmetrically , immediately posterior to the ventral sucker. Sem. ves. a convoluted canal lying anterior to the ventral sucker. Ovary vermicular in form, lying transversely near the posterior end of the body and forming a large loop. Vitellaria consist of several long branches which are again subdivided. L. canal present; sem. rec. absent . Uterus very long, forming several convolutions between the two intestinal ceca. Eggs fairly large, numerous.
Habitat: inthe air-bladder of fishes.

Nicoll (1927) shows the synonymy of these genera.
The type species is Isoparorchis trisimilitubis Southwell 1913

Isoparorchis trisimilitubis Southwell 1913

Length 19-35mm.; width 9-20 mm. Therefore one of the largest trematodes. Body form broad oval, widest near the middle. Oral sucker 1.3 - 1.4 mm.; ventral sucker 2.5-2.8 mm. (ratio 1:2) Branches of the vitellaria well separated from each other. Eggs 40- 43 by 20 (?) u. Host: Wallago attu . Immature in Barbus tor and Ophiocephalus striatus.

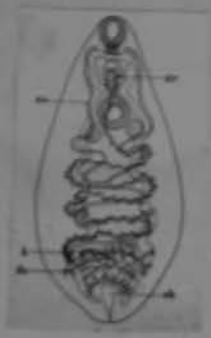
Isoparorchis eurytremum (Kobayashi) 1920

Length 17 mm. Width 6 mm. Greatest width in posterior third Oral sucker 1.3 mm., ventral sucker 1.9 mm; ratio 2;3. Vitellaria closely branched filling hind end. Eggs 48-51 by 26 u. Host: Parasilurus asotus and Pseudobagrus aurantiacus.

Isoparorchis eurytremum is found immature in Hypomesus olidus (Salmonidae) and Richardsonius hakuensis. (Cyprinidae)

The third species in this is genus is

Isoparorchis hypselobagri (Billet) Nicoll 1927



Isoparorchis eurytremum
fig from Kobayashi, 1921

Njamont in Ann. Parasit. 10:453-457, 1932 says there is only one species of Isoparorchis:

I. hypselobagri (Billet 1898) Odhner 1927

Synonyms: Distomum hypselobagri Billet 1898
I. trisimilitubis Southwell 1913
Leptolecithum eurytremum (Kobayashi, 1915
I. eurytremus (Kobayashi 1915) Travassos
I. tandani T. Johnston 1927

The ♂ terminal organs are described as Bhalerao (1926). The genital cone lies in a genital atrium which is surrounded by a sac enclosing also a posterior region in which lie a portion of the uterus & the ejaculatory duct. These two units at the base of the cone. Enclosed also in the cirrus-sac-like organ is a fibrous tissue diagrammed but not described by Bhalero. The cirrus-sac-like organ is unusual in containing a part of the uterus. No prostate gland was mentioned. Seminal vesicle ends at anterior border of ventral sucker.

No definite statement that branches of excretory vesicle unite.

(over)

Odhner (1927) states that the "cirrus-sac-like" structure of Bhalerao is the fibrous muscular genital cone lying in the atrium – it contains the vagina & the ejaculatory duct.

Subfamily HETEROSTOMATIDAE Dollfus 1932.
Genus *Isoparorchidae* Pande 1938.
Isoparorchis Southwell 1913.
Isoparorchis hypselobagri (Billet 1898) Odhner 1927.
(Synonyms: *Distomum hypselobagri* Billet 1898;
Isoparorchis trisimulilobis Southwell 1911
Leptalecithum curytremum Kobayashi 1915 & 1921.
Isoparorchis bindrai Johnston 1927).

Bhalerao (1936) recorded this fluke from 6 species of fishes in Hyderabad, viz., *Notopterus notopterus*, *Ophicephalus marulius*, *O. punctatus*, *O. striatus*, *Gobius giuris* and *Mastacembelus armatus*. The writer having examined a large number of fishes in different seasons of the year finds it to be of common occurrence in food fishes of Hyderabad. It occurred twice in the body cavity of *Notopterus notopterus* and *Glossogobius* (*Gobius*) *giuris*, and was recovered once from the body cavity of *Mastacembelus armatus*. Its metacercaria, however, was obtained on several occasions from the cysts in the body muscles of *Channa* (*Ophicephalus*) *marulius*.

The writer also found this fluke in the following other food fishes in Hyderabad. It was found twice in the gas bladder of *Wallagonia* (*Wallago*) *attu* from which largest sized specimens were obtained. Three more Siluroid fishes, *Callichrous bimaculatus*, *Clarias batrachus* and *Mystus* (*Macrones*) *tengara* were also found to harbour this parasite in the body cavity. Encysted metacercaria in muscles occurred in large numbers in the common food fish *Ophicephalus striatus*. In some cases the entire muscular portion of the body was heavily infested with hundreds of metacercaria, rendering the fish unfit for human consumption. It was also observed that infections are common in the later half of the year, largest numbers occurring during October and November. Normal hosts of this fluke appear to be mostly Siluroid fishes, in the gas bladder and body cavity of which the flukes are capable of developing into mature worms. On the other hand Ophicephalus species appear to be wrong hosts in which only metacercaria are found encysted in muscles and in which the flukes are incapable of developing into adults.

From Jaiswal, 1957

H. Sclerodistomatidae Dollfus (1932)
(Syn: Isoparorchidae Poche 1925)

Isoparorchis Southwell (1913)

Isoparorchis hypselobagri **Billet (1898), Osmer (1927).** (Synonyms: *Distomum hypselobagri* Billet 1898, *Isoparorchis trisimulitubuis* Southwell 1913, *Leptolecithum emytremum* Kobayashi 1915 and 1921, *Isoparorchis tandani* Johnston 1927). This parasite was for the first time recovered from the body cavity of turtale in Hyderabad. The flukes obtained were young adults having well differentiated gonads.

Host: *Kachuga kachuga*. — Habitat: Body cavity. — Locality: Hyderabad, India.

Lucknow, L.S. 1958

ISOPARORCHIS HYPSELOBAGUS (BILLET, 1898) ODHNER, 1927

sp. n. **Isoparorchis tandani**, ~~n. sp.~~ T. H. JOHNSTON, 1927

A. Figs. 1-4.

This is a large trematode, specimens examined measuring 30 mm. by 15 mm. (somewhat compressed), 25 mm. by 12 mm., and 21 mm. by 11 mm., while the smallest measured 17 mm. by 8 mm. and possessed abundant ripe eggs. The anterior end is thickest and somewhat pointed, the posterior being rounded. There is little variation in the width of the parasite from the region of the testes to that of the ovary, though compressed specimens may show a considerable widening in the middle third.

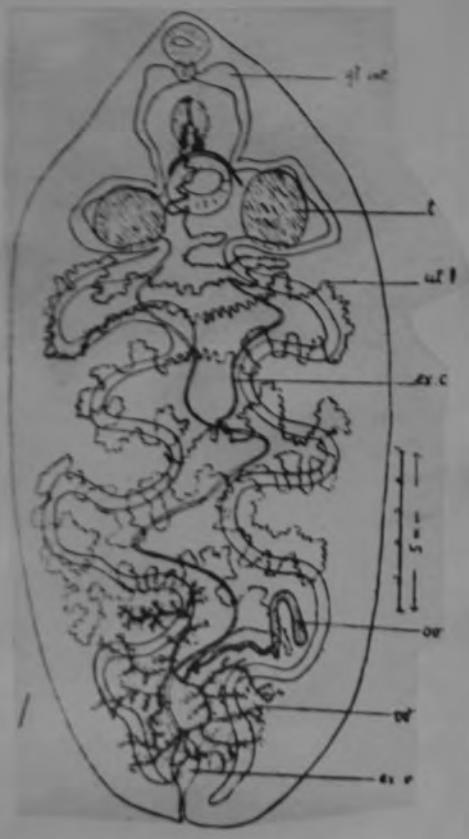
The body (when preserved in formalin) is more or less transparent, the darkly-coloured uterus and intestine showing through very plainly, while the rounded whitish testes are also very obvious, especially from the dorsal aspect. The cuticle is smooth. In the case of the larger worms the diameters of the anterior and ventral suckers were 1·7 mm. and 2·1 mm. respectively (ratio 1:1·2); 1·6 mm. and 2·1 mm. (ratio 1:1·3); 1·0 mm. and 1·2 mm. (ratio 1:1·2). The prominent ventral sucker is situated at about one-fifth the body length from the anterior end. The genital pore lies in the midventral line and at a distance from the oral sucker about one-third the interval between the latter and the acetabulum. There is a muscular pharynx, about 0·6 mm. in diameter, continuous with the oral sucker which it partly overlies, and is succeeded by an extremely short oesophagus which overlies it dorsally. The latter soon branches into two long simple intestinal caeca which are thrown into a fairly regular series of curves—a slight one between the two suckers in the vicinity of the genital pore, then the limbs of the intestine approach the ventral acetabulum sucker very closely; then follows a wide loop partly investing the corresponding testis, this being followed by four others, the last being slight, while the one anteriorly to it lies in the vicinity of the ovary. The ends of the caeca approach very closely to the excretory vesicle at the posterior extremity of the worm. The extreme anterior portion of each caecum is specialised as a "glandular stomach" and differs in appearance from the rest of the tube.

The main excretory canal is long and sinuous, extending from the rather large excretory vesicle to a point near the middle of the length of the parasite, where it bifurcates, each limb passing forwards in a series of curves near the intestinal loops.

The testes are rounded, entire and approximately equal, measuring 1·5 mm. to 2 mm. in diameter. They lie on either side of the acetabulum, their anterior border being more or less on a level with the middle of the sucker. They are closely invested by the intestinal loops. The vasa efferentia arise from the inner anterior margins and pass just in front of the ventral sucker as very narrow tubes which soon join to form a swollen vesicula seminalis. The latter is thrown into a number of close coils and then becomes a very delicate, rather long, ejaculatory duct which travels in a sinuous or slightly coiled course above the uterine coils, and then diverges somewhat from the latter to enter the muscular genital sac. It terminates beside the uterine pore, at the bottom of the ductus hermaphroditicus.

The ovary is a long tubular organ, more or less bent in various directions, measuring over 9 mm. in the longest specimen examined, and over 6 mm. in the next longest. The width is about 0·25 mm. It may lie on either side, since in four mature specimens it was found on the right, and in two on the left. Its general position is more or less transverse, though the outer end may be bent posteriorly. Its inner portion becomes markedly narrowed into a short oviduct whose lumen is only 0·01 mm., sufficiently wide to admit the passage of an ovarian egg, the latter measuring about 0·015 mm. in diameter, but capable of elongating as it travels down the duct. The latter soon receives the vitelline duct and becomes sharply bent back on itself as the ootyp, which is very narrow (about 0·012 mm. in diameter). This uterine duct passes beside and immediately above the oviduct for a short distance, and then widens into the uterus in the vicinity of the lower (*i.e.*, inner) part of the ovary, becoming thrown into a series of coils and loops, some of which overlie the uterine duct. The uterus is a very long, rather narrow, duct thrown into a series of wide curves passing across the worm between and slightly beyond the intestinal caeca and dorsally to them, each curve being thrown into a series of smaller undulations. In the vicinity of the acetabulum the tube becomes narrow again, passing above dorso-laterally to the sucker, thence forwards below the vesicula seminalis and ejaculatory duct to enter the muscular genital sac and terminate at the ductus hermaphroditicus.

The genital sac, which, apparently, is homologous with the cirrus sac of other trematodes, is a very muscular organ, 0·8 mm. to 1 mm. wide, surrounding the terminal part of both male and female ducts, particularly the latter. The ductus is eversible, as some preparations show the organ partly extruded as a wide structure projecting through the genital pore. The enclosed portion of the uterus and ductus is surrounded by a layer of deeply staining (? glandular) cells.



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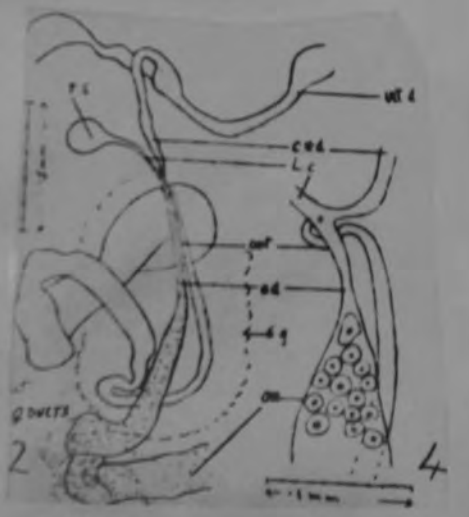

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- OVER -

The two vitelline glands are greatly branched and lie in the posterior quarter of the parasite, the one on the ovarian side being rather more posteriorly situated than its fellow, and, besides, it invades the other side somewhat. The glands are markedly dendritic, each consisting of about five main branches which subdivide two or three times and terminate in a great number of short processes, so that the two glands appear somewhat like an irregular broken network occupying the space behind the uterus and ovary and between the intestinal crura, though they overlap parts of the latter and may extend laterally beyond them. Except in the vicinity of the shell gland no part of the ovary or uterus is covered by the vitellarium. The two glands are connected by a swollen duct from the narrower mid-region of which a common vitelline duct is given off ventrally to curve forwards and after a short course join the oviduct as it enters the shell gland. At the junction there is given off dorsally a short Laurer's canal terminating blindly in a rounded or pyriform receptaculum seminis, 12 mm. in diameter, which lies ventrally to parts of the vitellarium. The shell gland is not a very obvious structure in stained preparations, though it occupies a considerable area, about 1 mm. by 65 mm. Eggs are thin-shelled and measure 45 μ to 52 μ by 25 μ to 27 μ. At the end opposite the operculum, the shell shows a small rounded apical thickening. The miracidium while enclosed in the shell is about 40 μ long.

The species obviously belongs to *Isoparorchis*, Southwell (1913), whose type species, *I. intermittabis*, occurs in the gas bladder of an Indian Siluroid, *Wallago attu*. The form herein described was recorded by me (1914) under its generic name only, from *Tandanus tandanus*, obtained from the Condamine River (Murray-Darling system) in Southern Queensland, and later (1916) from the same host species in the Dee (Dawson-Fitzroy system) and Burnett Rivers which belong to the Pacific slopes.

In 1920 Kobayashi (p. 98) described a new genus and species, *Leptolecithum eurytremum* as infesting the gas bladder of certain Japanese Siluroids. In June, 1926, Bhalerao announced the synonymy of the two genera, tabulated the chief characters of the two parasites, and concluded that they belonged to Southwell's species. He also mentioned that the ovary was situated on the right in the Indian parasite, and that perhaps Kobayashi may have been in error in describing the organ as lying on the left in the Japanese material examined. I have shown above that both men may have been correct in their statements, as the organs may be placed either on the left or on the right side in the Australian species. A comparison of the figures given by Southwell and Kobayashi, together with the distribution of the hosts in each case, leads one to disagree with Bhalerao's view as to the identity of the species. There are marked differences in regard to the general outline of the worms; the relative sizes of the two suckers and their distance from one another in relation to body length; the size of the testes; and the position at which the main excretory stem bifurcates. It is in all of these points that both *I. intermittabis*, Southwell, and *I. eurytremus* (Kobayashi) differ from *I. tandani*. All known members of the genus occur in the gas bladder ("gall bladder" in Bhalerao's table, p. 247, being obviously a misprint for gas bladder) of Siluroids.

Kobayashi placed his genus in the Hemiuridae and stated that it was related to the *Distomum clavatum* group. This latter assemblage has been assigned to *Hirudinella*, and was regarded by Odhner (1911) as belonging to an undesignated subfamily, but Nicoll (1914) listed it under Accacoeliinae. Manter pointed out many similarities to the Azygiidae except in regard to the form of the vitellaria (which are tubular in *Hirudinella*) and the position of the ovary and testes, the latter being immediately postovarian. The strongly muscular body of *Hirudinella* as well as the position of the various sex organs mark the genus off sharply from *Isoparorchis*. In *Accacoelium* the testes are postacetabular, one behind the other, the ovary a little distance posttesticular and the vitellaria dendritic along each side of the body. Except for the position of the vitellaria, *Isoparorchis* shows certain similarity to *Leucochloridium* (which is usually placed in the Azygiidae in spite of the relative positions of the testes and ovary, though Goldberger, 1911, regarded it as probably representing a new family), and especially to *Halipegus*.

Isoparorchis does not seem to fall into any of the known subfamilies of Hemiuridae, though it appears nearer to the Accacoeliinae. It is suggested that a new subfamily Isoparorchinae be erected to receive the genus, a provisional diagnosis being:—Hemiuridae; body weakly muscular; posterior region not telescopic; testes preovarian, near acetabulum; ovary posttesticular; vitellaria dendritic, postovarian; uterus preovarian.

With *Halipegus*, Looss, and *Derogenes*, Lühe—especially the latter—show affinities with the new subfamily, though the form of the viteline glands differs in each case, being dendritic in *Isoparorchis*, rounded in *Derogenes*, and composed of a few short rounded lobes in *Halipegus*. It is of interest to note that Lühe (1909) placed these two genera in the vicinity of the Dicrocoeliinae and Hemiuridae, whereas Pratt (1902) included *Derogenes* in the latter and regarded *Halipegus* and *Accacoelium* as related to the Syncoeliinae. Nicoll (1910, p. 348) seems to have been in doubt regarding the systematic position of *Derogenes*, as he listed it under "subfamily ? Derogeninae," though he subsequently (1914, p. 487) placed it under the Syncoeliinae, as also did Manter (1926, p. 100). The absence of a cirrus sac in *Halipegus*, and the presence in *Derogenes* of a muscular

organ surrounding the ends of both male and female ducts, as in *Isoparorchis*, should be noted.

Isoparorchis hypselobagri (Billet, 1898) Odhner, 1927
Syn. *Distomum hypselobagri* Billet, 1898
Isoparorchis trisinitlitubis Southwell, 1913
Leptolecithum eurytremum Kobayashi, 1915
Isoparorchis tandoni Johnston, 1927
Isoparorchis pakistani Bilqees and Khatoon, 1972
(Fig. 25)

Host: *Wallago attu* (Bloch. and Schneider)
Location: Swim bladder
Localities: Dera Ismail Khan; Taunsa Barrage and Hyderabad

Sixteen worms were collected from air bladder of twelve *Wallago attu* (Bloch. and Schneider) from three localities, Dera Ismail Khan, Taunsa Barrage and Hyderabad in August, November and December, 1967 respectively.

Description

The body of the worm is very large and foliate. The body surface is smooth, with margins turned over ventrally. The posterior end is broader than enterior end. The rounded oral sucker is subterminal and is surmounted by a short pre-oral lobe. The prepharynx is absent. The pharynx is smaller than oral sucker and partly overlaps the latter. The oesophagus is very short. The caeca are with stomach portions near their commencement. They run sinuously to the posterior end of the body. The acetabulum is in anterior third of the body. It is larger than the oral sucker and is spherical in shape.

The testes are rounded to oval in shape. They are placed posteroleteral to acetabulum. They are slightly asymmetrical in position. The left testis is slightly larger than the right testis. Vesicula seminalis is tubular and convoluted. It is situated in front of ventral sucker, only its posterior end over-reaches the anterior border of ventral sucker. The ductus ejaculatorius arises from the anterior end of the vesicula seminalis. The spherical hermaphroditic duct is highly muscular. The genital pore is median and preacetabular. The ovary is tubular, winding on the left side near the posterior extremity. The branched vitellaria lie near the posterior end. The branches of vitelleria over-reach the caeca laterally. Anteriorly they extend upto ovary while posteriorly they terminate a little before the caecal end. The uterus is extensive and occupies most of the postacetabular region of the body. The eggs are numerous, oval, brown and operculate. The excretory vesicle is Y shaped. The excretory stem is sigmoid and dilated posteriorly.

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Measurements (In Mm.)

Body length 18.480-19.000, Body width 9.210-9.670, Oral sucker 1.020-1.090 × 1.070-1.120, Ventral sucker 1.430-1.490 × 1.430-1.490, Pharynx 0.350-0.352 × 0.610-0.612, Right testis 1.240-1.300 × 0.970-1.020 Left testis 1.020-1.080 × 0.990-1.030, Ovary 1.860-1.900 × 0.150-0.160, Genital atrium 0.680-0.700 × 0.630-0.660, Eggs 0.040-0.242 × 0.020-0.021.

Discussion

The specimens under study resemble *Isoparochis hypselobagri* (Billet, 1898) Odhner, 1927 in all the essential character and are, therefore, identified as such. Recently Bhutta and Khan (1975) have reported this species from swim bladder of *Wallago attu* in Peshawar area.

From ZAIDI AND KHAN, 1977

Isoparorchis hypselobagri (Billet, 1898) Odhner, 1927.

Syn. *Distomum hypselobagri* Billet, 1898.
Leptalecithum curytremum Kobayashi, 1915.
Isoparorchis tandoni Johnston, 1927.
I. pakistani Bilqees and Khatoon, 1972.

(Fig. 6)

The following study is based on 13 flukes recovered from the air bladder of two specimen of *Wallago attu* collected from Peshawar.

The body of the worm is large, dorsoventrally flattened, foliate, oval to oblong in shape, depending on the state of contraction. The anterior end is narrow; whereas the posterior end is comparatively broader. The tegument is devoid of any armature. The spherical oral sucker is surmounted by a short preoral lobe. The ventral sucker, which lies in the anterior half of the worm at a distance of 2.909 mm from the anterior extremity, is one and a half to three times as large as the oral sucker. The prepharynx is absent. The pharynx is smaller than the oral sucker and almost globular in outline. The oesophagus is short and leads into a stomach from the lateral sides of which arise the two long and serpentine caeca. The caeca terminate a short distance in front of the posterior extremity and vary in diameter throughout their extent and are provided with short diverticula.

The testes are oval in shape, situated at the posterolateral sides of the ventral sucker, sometimes partly over-reaching its borders. They are slightly asymmetrically placed. The intertesticular space is 0.757 mm. The cirrus pouch is absent. The vesicula seminalis is long, tubular and winding structure which for the most part lies in front of the ventral sucker and its only posterior end may over-reach the anterior border of the ventral sucker. The ductus ejaculatorius arises from the anterior end of the vesicula seminalis. The spherical hermaphroditic sac is highly muscular and communicates with the exterior through a median, preacetabular genital pore, situated immediately behind the intestinal fork. The tubular and winding ovary is situated near the posterior extremity and is submedian in position. The vitellaria are dendritic, lying near the posterior extremity and are almost median. The branches of the vitellaria over-reach the caeca laterally. Anteriorly they extend to a short distance in front of the ovary ; whereas posteriorly they terminate a little short of the caecal ends. The uterus is extensive and occupies most of the post-acetabular region of the body. The metraterm is well-developed. The eggs are numerous, medium-sized, oval, brown and operculate. The excretory vesicle is Y-shaped. The excretory stem is sigmoid and dilated posteriorly. The excretory arms are serpentine and extend anteriorly to about the pharyngeal level.

6

Host: *Wallago attu*
Location: Air bladder
Locality: Peshawar area

Discussion

The worms under present study resemble *Isoparorchis hypselobagri* (Billet, 1898) Odhner, 1927 in all essential features.

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MEASUREMENTS

(All measurements in millimetres)

Body length	14.00 – 18.00
Body breadth	5.00 – 10.20
Preoral lobe	0.147 – 0.196
Oral sucker	0.696 – 0.848 × 0.787 – 0.878
Ventral sucker	1.212 – 1.818 × 1.212 – 1.818
Pharynx	0.323 – 0.454 × 0.294 – 0.454
Testes	0.696 – 0.878 × 0.757
Eggs	0.051 – 0.056 × 0.025 – 0.030

From BHUTTA AND KHAN, 1975

Isoparorchis trinimilitubis, sp. nov. Southwell, 1913

(Pl. viii, figs. 9-11; and pl. ix, fig. 12.)

These Trematodes were first discovered infesting the air bladder of an adult specimen of the Silurid fish, *Wallago attu* (Bengali, *Boali*), caught in a freshwater tank at Bankipur, in March 1912. Since then, large numbers of specimens have been obtained, and every adult fish examined was found to be infected. Immature forms of this parasite have since been noted to occur in the flesh of the Mahseer (*Barbus tor*). Specimens of *Wallago attu* occur extensively in nearly all rivers of North and North-east India, and during the floods their larvae and fingerlings enter the tanks and the paddy fields. The fish is exceedingly voracious.

The following are the dimensions of a few of the parasites from *Wallago attu* :—

Specimen.		Length.		Breadth.
(*a*)	..	33 mm.	..	16 mm.
(*b*)	..	30 mm.	..	20 mm.
(*c*)	..	35 mm.	..	18 mm.
(*d*)	..	28 mm.	..	17 mm.
(*e*)	..	25 mm.	..	13 mm.
(*f*)	..	26 mm.	..	12 mm.
(*g*)	..	19 mm.	..	11 mm.
(*h*)	..	20 mm.	..	9 mm.
(*i*)	..	19 mm.	..	10 mm.
(*j*)	..	10 mm.	..	4·5 mm.

The thickness of the largest worm was ·9 mm., that of the smallest ·2 mm. (approximately). The dimensions and thickness of the worms varied a little according to the degree of contraction.

The parasites were killed in an expanded condition by spreading two drops of spirit over the surface of the body. The worms in every case expanded. When fully expanded, they were plunged into 5 per cent formalin. For the determination of the anatomy, a few specimens were dehydrated, cleared in clove oil, and mounted whole. A few were stained with Delafields Haematoxylin, and others with Borax Carmine. I did not prepare sections, but made careful dissections of the genital organs.

External characters.—The parasites are leaf-like and of a deep flesh-colour, roughly oval in shape, the posterior margin being broadly rounded and the anterior extremity being produced into a rather long, thickened, acute projection with a rounded extremity. The thickening is apparently due to the presence of the cirrus sac. This projection shows a marked tendency to curve ventrally and assume a position at right angles to the body. The oral sucker is situated somewhat ventrally, at the extreme anterior. In the largest specimen (referred to as *c*) the diameter of the sucker was ·7 mm. In the same specimen the ventral sucker was situated 7 mm. from the anterior extremity and had a diameter of 1 mm. with extremely thick muscular walls. The genital aperture is situated midway between the oral and the ventral suckers and had a diameter of ·85 mm. The aperture of the excretory apparatus is situated posteriorly and is median. In mature specimens the testes can be seen as opaque milky-white globular bodies, 1 mm. in diameter, situated one on each side, and slightly posterior to the ventral sucker. The vitelline glands are conspicuous as darkish masses aggregated on the posterior dorsal surface and disposed principally round the posterior termination of the two rami of the gut. These two rami stand out prominently as a pair of black sinuous tubes having a diameter of 1 mm., and running from the anterior to the extreme posterior end of the worm, where they terminate blindly. They occupy a considerable part of the middle ⅓rds of the length and breadth of the worm. The uterus is just visible as a delicate sinuous tube starting from the posterior end, running along the posterior laterally-directed loop of one ramus of the intestine, across to the laterally directed loop of the other ramus of the intestine, etc., to the genital aperture. Under magnification the tissue of the parasite presents a granular appearance.

Digestive system.—The mouth is situated at the base of the oral sucker and leads directly into a stout muscular pharynx. The œsophagus is exceedingly short and divides immediately into the two rami forming the intestine. Each branch runs at first straight towards the lateral margin of the worm and, rounding the ventral sucker laterally, runs ventrally to the posterior end in the form of a continuous letter **S**. The two rami do not lie symmetrically. The centrally directed loop of one ramus is situated opposite the laterally directed loop of the other ramus. The disposition of the coils of the uterus round these loops will be noted later. The two rami of the intestine extend to the extreme posterior extremity, where they terminate blindly, close to each other. The wall of the intestine is pigmented with very dark brown, almost black, and is minutely, annularly rugose throughout its length.

Excretory system.—Unless sections are made the gross details of this system cannot be made out, except perhaps in the living worm, and not always then.

The excretory aperture is situated at the posterior margin of the worm and is median. This aperture leads into a more or less globular or cylindrical contractile vesicle. From this vesicle the excretory duct runs forward a little distance and then bifurcates. The two branches follow the contour of the two rami of the intestine, one on each side, to a point near the ventral sucker, beyond which they could not be traced. The inwardly directed loops of the branches of the excretory duct, however, extend much nearer the median line than do the corresponding loops of the intestine.

Reproductive system: (A) *Male.*—The testes are a pair of opaque globular bodies 1 mm. in diameter, situated one on each side of, and very slightly behind, the ventral sucker, and one testis is slightly anterior to the other. The efferent canals run forward towards the median line of the body where they appear to meet just in front of the ventral sucker. The vas deferens is short. The vesicula seminalis was not clearly made out. As sections were not prepared it was impossible to make out further details.

(B) *Female.*—The germarium is single and is situated posteriorly, and just anterior to the last inwardly directed loop of the right ramus of the intestine, and about 5 mm. from the posterior margin of the worm. It lies transversely as a sinuous tube. The uterus is a very long sinuous tube which first runs along the penultimate laterally directed loop of the right ramus of the intestine. It then runs across the body of the worm and along the penultimate laterally directed loop of the left ramus of the intestine. Then across the body again to the antepenultimate laterally directed loop of the right ramus of the intestine, etc., to the anterior, where it passes dorsal to the ventral sucker, to the genital aperture. The vitelline glands lie on the posterior dorsal surface. They consist of a large number of grape-like follicles connected to a duct which opens to the germarium close to the junction of the germarium with the shell gland. The shell gland is situated close to the junction of the vitelline duct with the uterus.

The recent advances made in parasitic zoology have resulted in the old genus *Distomum* having been split up into over eighty new genera. As far as I have been able to ascertain our specimens are not closely related to any of these genera.

A few specimens of this parasite were found in the flesh of a Mahseer (*Barbus tor*) caught by Capt. Parker, R.A.M.C., Sanitary Officer, Poona (Bombay Presidency), in April 1910, and were sent by him to the Indian Museum. The specimens were afterwards sent to Dr. Liepèr of the Tropical School of Medicine, London. A single mounted specimen was retained in the Indian Museum and this I have examined. It measured 8 mm. in length, and the greatest breadth was 4 mm. It was immature.

Capt. Parker states that the parasite in the flesh of the Mahseer was surrounded with black pigment, and that the pigmented area extended to the surface of the skin, thereby suggesting that the parasites had bored their way in. As, however, these worms have no armature, this seems unlikely. Mahseer occur generally throughout India, but are found in greatest abundance, and of largest size, in mountain streams or [illegible]

11.

A. Chowdhary, lit.

Wallago attu occurs throughout India, Ceylon and Burma. If Mahseer is a normal host of this parasite, then two hosts are now known. The host, or hosts, in which the earlier larval stages, sporocyst, redia and cercaria, occur, have still to be discovered.

Wallago attu is an exceedingly voracious fish and doubtless feeds amongst other species on *Nandus marmoratus*. It is possible that the mature Distomid described from *Wallago attu* may be the adult of the young Distomid described in this paper from *Nandus marmoratus*. The principal and only obvious differences lie in the fact that in the young form of this worm the gut is not sinuous, but this may become so when the parasite becomes adult. In that case the Mahseer (*Barbus tor*) becomes a collateral host only.

An immature Trematode from the ovaries of *Nandus marmoratus*, Ham. Buch.

Leptolecithum curytremum sp. KOBAYASHI, 1921

Diagnosis. Size of mature distome 13 mm. × 7 mm. Both suckers large, the ventral sucker being the larger of the two. Intestinal caeca make about five lateral bends. Stem of the excretory vesicle a broad canal at its posterior part, but at the level of the shell-glands it narrows abruptly and forms lateral bends between the intestinal caeca; at the middle of body it bifurcates, both arms make similar bends and finally end near the pharynx. Margin of testes entire. Vitellaria consist of about four to five large branches, which divide several times. Ovary a long tube about 2-3 mm. in length, lying transversely and often contorted. Uterus occupies the space between the intestinal caeca and makes about three large transverse bends, each of which has fine undulations. Cirrus-pouch (?) a large ellipsoidal muscular mass, slightly protruding in the depression between the pharynx and the ventral sucker. Eggs 0·048–0·05 mm. × 0·023–0·025 mm. Habitat: in the air-bladder of *Parasilurus asotus* and other fish.

DESCRIPTION. The mature specimens of this species are found in the air-bladder of *Parasilurus asotus* and *Pseudobagrus aurantiacus*, more commonly in the former. Several specimens ordinarily occur in one host. In the coelom of the above two species of fish and *Hypomesus olidus* and *Richardsonius balteatus*, immature specimens are found. These immature specimens are commonly found near the anterior part of the coelom or in the vicinity of the anus. The parasite has been collected from various places in the Okayama Prefecture, Sahara (Chiba Prefecture), Kasumiga-ura (Ibaraki Prefecture) and Lake Biwa.

A mature specimen measures 13 mm. long and 7 mm. wide at the broadest part. The body is compressed dorso-ventrally, broadest at the middle or the posterior third of the body, and tapering anteriorly and posteriorly. It has on the whole a leaf-like shape. The ventral surface is often slightly concave. In the fresh state, it appears flesh pink, showing blackish colour, due to the intestinal contents, along the intestine. The living parasites move on slowly by the contraction and elongation of the body.

The cuticle is smooth and measures 0·04 mm. in thickness. The oral sucker has a diameter of 1·2 mm. and is situated on the antero-ventral end. The ventral sucker is slightly larger than the oral, being 1·4 mm. in diameter and is situated at the anterior third. The pharynx is directly continuous with the oral sucker and has an elongate form, the size being 0·85 mm. × 0·5 mm. In the entire preparation the oesophagus cannot be detected, but in sections a short oesophagus is recognisable postero-dorsal to the pharynx, which soon bifurcates into two intestinal caeca which turn laterally at right angles and for a certain distance show the same structure as the oesophagus, being lined by cuticle. This part corresponds to the crop of *Distomum nopallaceum* as described by von Buttel-Reepen[1]. Ultimately, each caecum widens into a sac-like portion, the glandular stomach (Drüsenmagen of the German author), which has special epithelium; each cell of which bears long flagella-like appendages, longest in the posterior portion, and measuring 0·06 mm. in length. The epithelium of the glandular stomach is continuous with the ordinary epithelium of the intestine. Both the caeca turn posteriorly and run along the lateral body margins with characteristic windings, some five turns; and then terminate near the posterior end of the body, where each approaches to the median line. The first turn of the intestine occurs near the anterior margin of the ventral sucker; the remaining four turns are situated posterior to the ventral sucker. The first turn is most remarkable and in some cases the caeca almost meet in the median plane.

The excretory pore opens at the posterior end of the body. The vesicle has the form of an exceedingly elongate Y, the stem and the two arms of which bend laterally several times. In young specimens the stem is straight or slightly curved, while in mature specimens it bends at right angles at the level of the ovary to the right and forms a spindle-shaped broad tube, which

—OVER—

becomes abruptly narrower and runs laterally and anteriorly, with two or three transverse bends, in between the intestinal caeca. Its anterior end reaches the middle part of the body and divides into two arms at the median plane. Each arm has a similar course to the stem, and after bending once or twice it reaches the level of the testes and passes over the intestinal caeca, then runs anteriorly along the lateral body margin and reaches as far as the pharynx. At this place it continues into the collecting vessels. The winding course is more marked in large and mature specimens, while in younger examples the entire vesicle usually takes a slightly undulating course.

Both the testes lie at the posterior lateral margin of the ventral sucker, immediately mesial to the intestinal caeca. Each of them has a somewhat round shape, and is 0·7 mm. in diameter. From their antero-mesial border the vasa efferentia arise. They run antero-medially and unite at the antero-dorsal margin of the ventral sucker to form the vas deferens. The vas deferens widens slightly to form the tube-like vesicula seminalis. In the mature specimen it bends 3–4 times, while in the younger form it remains straight. Anteriorly the vesicula seminalis enters into a cirrus-pouch-like muscular organ and continues into the ductus ejaculatorius. Both structures make several windings. The distal end of the ductus ejaculatorius is united with the vagina and forms the ductus hermaphroditicus. The cirrus-pouch-like organ is situated midway between the two suckers; it has an elliptical shape and measures

[1] Buttel-Reepen, H. von (1902). Zur Kenntniss der Gruppe des *Distomum clavatum*, etc. *Zool. Jahrb.* Ab. Syst. etc. XVII.

2 mm. × 1·2 mm. At its anterior part a depression is present on the body surface, the genital atrium. A part of the cirrus-pouch-like organ protrudes into the atrium to form the genital papilla, at the apex of which the ductus hermaphroditicus opens.

The ovary lies at the level between the fifth bend of the intestinal caeca, slightly to the left of the median plane. It is tubular, winding irregularly several times; it measures about 2·3 mm. × 0·15 mm. Its median end opens into a broad and short oviduct. Laurer's canal is present and opens dorsally, while the receptaculum seminis is lacking. The vitellaria are situated at the posterior part of the body around the ovary and between the intestinal caeca. The distal end of the glands passes over the intestinal caeca. They have a dendritic form, are finely branched, and, in the mature specimen, the left and right halves are barely distinguishable. The main branches are 5–6 in number; they are united with one another in the anterior median part and distally they divide into finer branches. The yolk duct arises at the anterior median part. It is short and soon forms a yolk reservoir. The shell-gland is diffuse and the glandular cells have long slender ducts. The uterus makes six loops and is situated between the two intestinal caeca; some parts pass over the caeca to the exterior and run at right angles to the longitudinal axis of the body. In each loop are found still smaller undulations, which are more numerous in the posterior portion. Around the uterus are certain glandular cells which have a similar appearance to the shell-glands, except that they are provided with a shorter duct. Distally the uterus runs directly over the dorsal border of the ventral sucker on the left side of the cirrus-pouch-like organ and is continuous with the vagina, which enters the cirrus-pouch-like organ. After making several windings it unites with the ductus ejaculatorius.

The eggs are numerous, the size being 0·048–0·05 mm. × 0·023–0·025 mm. A distinct lid is present.

It is clearly seen that this species has affinities with the Hemiuridae, especially to the group of *Distomum clavatum*.

I have once found a very young specimen of this species in the gills of *Pseudobagrus auranticus*. The shape is ovoidal, the anterior end being rounded, while the posterior end is somewhat tapering. Its size is 0·35 mm. × 0·2 mm.

The broadest part is the posterior third of the body. The oral sucker lies at the antero-ventral end, the diameter being 0·12 mm. The ventral sucker lies slightly posterior to the middle of the body, the diameter being 0·18 mm. Between the suckers the cirrus-pouch-like organ lies, touching the oral sucker anteriorly and the ventral sucker posteriorly. Both testes lie directly postero-ventrally to the ventral sucker; their shape is ellipsoidal, and each measures 0·05 mm. in diameter. The ovary lies slightly posterior to the testes, between which it is transversely elongated in the median plane; its length is 0·03 mm. The vitellaria are seen as an irregular cell-mass, lying posteriorly to the ovary.

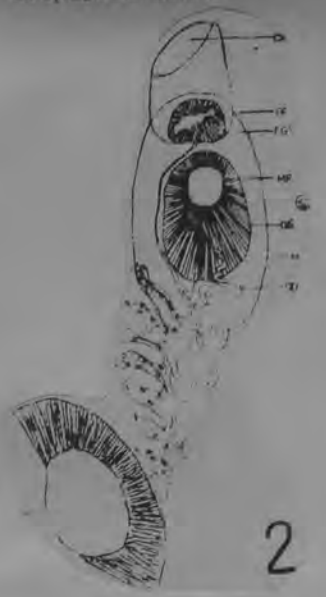
It is very interesting to note that in the coelom of the host no mature specimens are met with. Similar young specimens are often found in the air-bladder. It seems probable, therefore, that the coelom is not a favourable situation for the maturation of this species.

A cercaria form, which seems to belong to this species, I shall reserve for future description.

Isoparorchis pakistani Bilqees and Khatoon, 1972

DESCRIPTION AND DISCUSSION

Trematodes large (Fig. 1) about 33—40 in length and 15—20 width. pre-oral lobe present. Oral sucker 1.29—1.31 × 1.77—1.9, pharynx 1.11—1.2 × 0.9—1.0. Practically no esophagus but "stomach" portions 0.75 × 0.90—0.77 × 1 0. A pair of prominent glandular structures 2.25—2.27 long present one on each side of the oral sucker extending up to the "stomach" portion, for which the term oral gland was used. First it was thought to be the dilated portion of the excretory ducts but the histological studies have not confirmed it. Caeca long; 0.2—0.3 wide, serpentine, running to posterior extremity. The posterior extremity of caeca were a little enlarged and was noticable even in the unstained and whole mount preparations. Acetabulum situated in the anterior one third of body measuring 1.17—1.62 × 1.7—1.8). A pair of unequal testes present just posterior to acetabulum one on each side. In the type specimen the larger testes measured 1.80 × 1.50 and the smaller 0.75 × 0.96. Three glandular structures posterior to large testes were connected with the testes of both side by fine ducts therefore the name testes glands was proposed for these. Besides the three larger testets glands many smaller similar structures were present apparently connected with the former (Fig. 3). Testes glands 0.84—1.62 in length: similar smaller structures 0.1—0.18 long. Anteriorly vas efferens arose from each testes uniting anterior to acetabulum. Hermaphroditic sac contained openings of male and female ducts which were surrounded by prominent suckers (Fig. 2). Hermaphroditic sac connected anteriorly with an elongated structure arising from the base of the female genital sucker and opening ventrally to the exterior by a transversely elongated pore. Hermaphroditic sac including anterior elongated portion measured 2.67 long by 1.65 at the greatest width.



Ovary 5.0—5.28 long and 0.3—0.45 wide, situated in the posterior region of the body. At the base of the ovary a comparatively small seminal receptacle was obvious measuring 0.27 × 0.24—0.29 × 0.28 in size. Seminal receptacle and base of ovary surrounded by a prominent shell gland, 0.72 × 0.54—0.81 × 0.64 in size (Fig. 4). The vitellaria near the shell gland had a small pyriform vitelline reservoir. Laurer's canal absent. Vitellaria dendritic posterior to the ovary and overhanging caeca laterally. Uterus forming transverse loops across caeca. Excretory vesicle single and dilated, opening to exterior at posterior end. Excretory tubes serpentine. Eggs 0.039—0.055 × 0.025—0.029

The above mentioned characters clearly indicate that the trematodes belong to the genus *Isoparorchis* but differ from previously described species, therefore a new species *I. pakistani* was assigned to them. To justify the validity of the new species hundreds of fresh water fishes were examined for the recovery of *Isoparorchis* specimen so that a comparison could be made. As there was a possibility that some of the structures observed in the new species were over looked by the previous workers. Two specimens of the same genus were recovered from the fish *Ophiocephalus striatus* and were identified *as I. trisimilitubis* Southwell, 1913, Yamaguti (1934) also described the same species from the same fish host. The anterior region of *I. trisimilitubis* is shown in Fig. 5. It was observed that there were no oral glands, genital sucker, and testis glands in *I. trisimilitubis* and the genital ducts open in the hermaphroditic sac by simple openings, the common genital opening was at the base of the sac, and the elongated atrium through which the common genital pore opens to the exterior in the new species also lacking. But the Laurer's canal was obvious, although not seen in the new species. Even if we do not consider the size differences of different structures the present specimens can be regarded as new because of the oral glands, testis glands, genital suckers, position of the common genital opening. The first three structures were not described by previous workers even in *I. hypselobagri* and *I. tandani* (Billet, 1898; Yamaguti, 1958; Johnston, 1927), nor are they apparent from their diagrams. The relative sizes of the oral sucker, acetabulum and testes in the new species is also different from the above mentioned two species. Laurer's canal is absent in *I. pakistani* while it is present in all the known species. The position of the common genital opening is also different in the previous species.

A metacercaria was also found in the body cavity attached to the muscles of body wall of *Eutropiichtys racha*. It was identified as *Isoparorchis* larva because of the stomach portions, serpentine intestine, excretory ducts, and a single dilated excretory vesicle (Fig. 6). It was 10.14 long and 4.76 wide. Oral sucker was 1.04 × 0.87, pharynx

0.38 × 0.45, and acetabulum was 2.48 × 2.07 in size. Two very small structures at the sides of acetabulum representing the developing testes were present. In the preacetabular zone the primordial male duct and hermaphroditic sac was obvious, while in the postacetabular region a bilobed mass of cells 2.73 wide was present probably the developing vitellaria as it was brownish in colour. No other structures were obvious. The fish *Entrophiichtys racha* represents a new host for larval *Isoparorchis*.

Immature forms have been described previously in many species of fishes of India (Southwell, 1913; Bhalerao, 1932), Japan (Kobayashi, 1915; Yamaguti, 1934) and Australia and Java (Bovien, 1927), but were not known from Pakistan.

HISTOLOGICAL STUDIES

The histological studies of *Isoparorchis pakistani* n. sp. have shown that externally the body was covered by a thick cuticle (= tegument) which was folded in some regions. The tegument took a pink stain and contained very minute dark blue staining granules at intervals arranged in groups. Below the tegument muscle fibres were present. As no special stain for these fibres was used these either remained unstained or were pink at some places.

A longitudinal section through the oral region (Fig. 7) showed that the oral glands were dilated at the ends and consisted of large spaces filled with a clear fluid containing some granules. Both in the whole mount preparations and histological sections the oral glands remained unstained with a yellowish fluid in them. The glandular area was lined with a delicate membrane without any cellular structures in it while the excretory ducts and vesicle had an epithelium like lining (Fig. 11). This indicates that the glandular areas in the oral region are not the part of the excretory system, and had some connection with the digestive system. In some specimens the oral glands appeared to be connected with the oral sucker.

The "stomach" was a large sac like structure consisting of an outer fibrous layer, a middle layer of cells, and inner irregular layer on which black granules were deposited. Similar structures were present in the "gastric cavity". The intestinal caeca also consisted of three layers but the inner layer was produced into finger like projections (Fig. 8), just like the intestinal villi of the higher animals lining the lumen of the caeca. Thorsell and Bjorkman (1965) described the microvilli in the intestinal caeca of *Fasciola hepatica* L. by electron microscope studies but no such structures are known by light microscopy. These villi-like structures, of the intestinal caeca of *I. pakistani*, probably perform the same function of increasing the absorbtive surface as in other animals. The absorbtive function of the internal lining of the intestinal caeca of *F. hepatica* has been described and discussed by Muller (1923), Stephenson (1947), Gresson and Threadgold (1959), and Dawes (1962). These structures in the new species were more prominent in the intestinal caeca of the middle region and not as much in the anterior and posterior regions. The lumen of the intestinal caeca contained a pink staining material with some black particles in it (Fig. 10). The black material was mostly accumulated on the villi-like structures (Fig. 8 A) which gave a black colour to the caeca even in unstained specimens.

The uterus did not appear as a straight tube in histological sections due to its transverse coils, and sections of different shapes of uterus were observed in the longitudinal sections of the trematodes (Fig. 9). It consisted of thick muscular walls and contained numerous oval eggs in its lumen. In some of the eggs a small dark blue staining nucleus was observed.

The vitellaria in sections (Fig. 10) appeared to consist of groups of large numbers of cells. Each cell had a dark brown nucleus and light brown surrounding area (Fig. 10A). At some places a large brown mass was noticed in the centre of groups of cells representing the main duct with brown material in its lumen. Each group of vitelline gland cells was surrounded by muscle fibres. In the more anterior sections of the vitellaria *i.e.*, near the ovary, the brown vitelline cells were scattered and were much smaller in size, which represent the sections of finer branches of vitellaria (Fig. 9).

(contd)

The histological structure of the excretory vesicle (Fig. 11) revealed that its lumen was surrounded by an epithelium like structure in which the nuclei were stained blue, and there were outpocketings of this layer in the lumen of the excretory vesicle (Fig. 11A) as in the urinary bladder of higher animals.

The structure of the testes was quite peculiar (Fig. 13). The parenchyma surrounding the testes appeared different than rest of the body, and was differentiated into an outer dark pink staining and an inner light staining area. Three structures were obvious in the testes (Fig. 13. 1,2,3.). There were some comparatively small nuclei-like dark blue staining structures without any obvious surrounding cytoplasm, some larger structures with many small blue staining granules in it, and the third were just like groups of small cells with blue staining nucleus and pink staining cytoplasm. These represent the stages in the development of sperms. Some of the dark staining structures were constricted. A little lower portion from the same section of the testis is shown in Fig. 14. Numerous dark blue staining spindle shaped sperms were present in this region. Besides this large blue staining oval structures in groups were also present. These were surrounded by dark pink staining areas without any noticeable lining membrane. Some of these structures, presumably sperm mother cells, had obvious chromosome divisions.

At higher magnification the section of the ovary indicated most active cell divisions (Fig. 12). Here also different types of cells with different staining reactions were present. Small dark blue staining structures were most obvious at the periphery of the section representing the follicle cells of the ovary of higher animals. The primordial sex cells with small blue staining nuclei predominated the central region. Similar larger cells were exhibiting divisions. In other sections mature eggs were also observed.

It was not possible to make a histological study of the testes glands because the trematodes were cut into pieces for sections cutting and at the beginning we had no idea about the testes glands therefore no particular attention was paid to prepare that region, for histological studies. Further studies might include the recovery of *I. pakistani* n. sp., (so that the host could be identified) and histological studies of its testes glands.

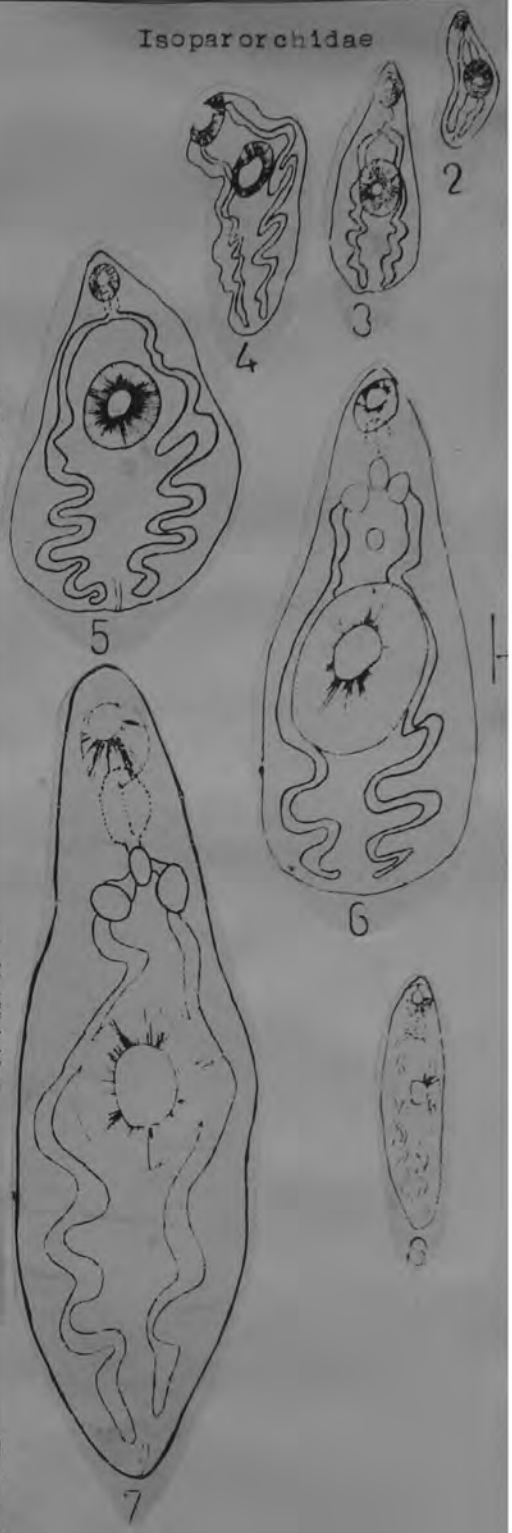
SUMMARY

A new species of fresh water fish trematode *Isoparorchis pakistani* was identified and observations were made on its histological structures. The present specimens were differentiated from *Isoparorchis hypselobagri* (Billet, 1898) *I. trisimilitubis* (Southwell, 1913) and *I. tandani* (Johnston, 1927) in having oral glands, unequal testes, lobular testes glands, male and female genital suckers which open in the hermaphroditic sac which in turn opens to the exterior by a transversely elongated genital pore. The common genital pore was anterior to hermaphroditic sac while in the previously described species it is in the middle or posterior to hermaphroditic sac. The oral glands and testes glands are the new terms used here as these structures are not described in the known species of the genus. The Laurer's canal was also absent in the new species.

The cuticle of *I. pakistani* contained groups of blue staining particles. A pair of glandular structures in the oral region were observed lined by a delicate membrane. The stomach was a thick walled sac consisting of three layers. The internal lining of the intestinal caeca was peculiar in producing villi-like projections as in higher animals and probably perform the same function. The wall of the excretory vesicle consisted of an epithelium like layer. The vitelline gland cells were also arranged in groups forming the main branches and were surrounded by muscle fibres. In the sections of testes developmental stages of sperms and fully developed sperms were observed, while in the ovary active cell division was obvious. The uterus consisted of muscular wall and contained mature eggs.

LARVAL FORMS OF ISOPARORCHIS.

Fig. (2--8).



Specimen 1.

HOST : *Mystus cavasius* (Ham).

LOCATION : Air-bladder.

LOCALITY : Kalri Lake (Sind) Area (West Pakistan).

NUMBER OF SPECIMEN EXAMINED : 1.

NUMBER OF HOST EXAMINED : 3.

Metacercaria found in Air-bladder of fresh water fish *Mystuscavasius* (Ham) was pink in colour when alive. Body small and bend towards the ventral side, translucent, measuring 2.18 × 0.34, mm. Fore-body 0.74 mm long. Oral sucker small, subterminal measuring 0.13 × 0.14mm. Acetabulum in anterior half of the body measuring 0.27—0.28. Sucker ratio 1 : 2. Pharynx contiguous. Oesophagus very short. Ceca long and serpentine. Testes, Ovary not developed. Excretory vesicle Y shaped.

Specimen 2.

HOST. *Nandus nandus* (Ham).

LOCATION : Air-bladder.

LOCALITY : Kalri Lake (Sind) Area (West Pakistan).

NUMBER OF SPECIMEN EXAMINED : 1.

NUMBER OF HOST EXAMINED : 3.

The immature form of *Isoparorchis* found in the Air-bladder of *Nandus nandus* (Ham) was reddish pink in colour when alive. Body large, foliate, translucent. When extended measuring 3.12 × 1.56 mm Fore-body 0 93 mm long. Oral sucker subterminal measuring 0.50×0.42 mm. Acetabulum equatorial, larger than Oral sucker measuring 0.93 × 0.94 mm. Sucker ratio 1 : 2.2. Pharynx small, measuring 0.12 × 0.18 mm. Oesophagus very short. Ceca long and serpentine Testes, Ovary and associated structures not developed.

Specimen 3.

HOST : *Ophiocephalus striatus* (Bl.)

LOCATION : Air-bladder.

LOCALITY : A canal of (Sind) Area (West Pakistan).

NUMBER OF SPECIMEN EXAMINED : 1.

NUMBER OF HOST EXAMINED : 7.

This was pinkish in colour when alive and translucent, Body twisted and bent towards the ventral side measuring 3.43 × 1.25 mm Fore-body 0.75 mm long. Oral sucker subterminal measuring 0.31 × 0.32 mm Acetabulum equatorial larger than Oral sucker measuring 0.56×0.50 mm. Sucker ratio 1 : 1.6. Oesophagus not visible. Ceca long and serpentine. Testes, Ovary and associated structures not developed.

Specimen 4.

HOST : *Wallagu attu* (Bl & Schn.)

LOCATION : Air-bladder.

LOCALITY : Kalri Lake (Sind) West Pakistan.

NUMBER OF HOST EXAMINED : 5.

(over)

NUMBER OF SPECIMEN EXAMINED : 1.*

This was red in colour when alive, anterior end narrow, posterior broad. Body smooth, measuring 5.31×4.72 mm. Fore-body 1.25 mm in length. Oral sucker almost round, subterminal 0.62 × 0.63 mm in size. Acetabulum much larger than oral sucker measuring 1.75 × 1.77. Sucker ratio 1 : 2.8. Oesophagus contiguous with pharynx. Ceca long and serpentine. Testes, Ovary and associated structures not developed. Excretory vesicle Y shaped.

Specimen 5.

HOST : *Xenentodon cancila* (Ham).

LOCATION : Air-bladder.

LOCALITY : Kalri Lake (Sind) West Pakistan.

NUMBER OF SPECIMEN EXAMINED : 1.*

NUMBER OF HOST EXAMINED : 1.

This was larger than the four specimens mentioned above. Deep red and translucent when alive. The body large in size, measuring 8.22 × 3.75. mm., Fore-body 3.12 mm long. Oral sucker, subterminal, ser-mounted by pre-oral lobe measuring 0.62 × 0.93 mm Acetabulum, in anterior half of the body very large in size, measuring 2.60 × 2.18 mm Sucker ratio 1 : 2.3. Pharynx contiguous with oral sucker. Oesophagus very short. Ceca sinuous and serpentine, stomach portion at commence-ment. Testes, ovary and other structures not developed. Excretory vesicle not observed.

Specimen 6

HOST : *Notopterus notopterus* (Pallas).

LOCATION : Air-bladder.

LOCALITY : Kalri Lake (Sind), West Pakistan.

NUMBER OF SPECIMEN EXAMINED : 1.

NUMBER OF HOST EXAMINED : 1.

The specimen dark red in colour when alive, translucent. Body larger than the five specimens mentioned above measuring 12.00 × 3.75 mm. Fore-body 4.37 mm long, Oral sucker subterminal, surmounted by pre-oral lobe, measuring 0.93 × 0.85 mm. Acetabulum, in anterior half of the body measuring 2.00 × 2.00 mm, almost round. Sucker ratio 1 : 2.3. Pharynx contiguous with oral sucker. Oesophagus very short. Ceca sinuous, long, serpentine, with stomach portion at commencement. Testes, ovary not developed. Excretory visicle Y shaped.

Specimen 7

HOST : *Silonia silondia* (Ham).

LOCATION : Muscles of stomach.

LOCALITY : Kalri Lake (Sind) West Pakistan.

NUMBER OF SPECIMEN EXAMINED : 1.

NUMBER OF HOST EXAMINED : 1.

This was found in muscles of the wall of stomach while the above were recovered from the air bladder. It has the same general appearance. Pinkish, translucent, when alive. Body small measuring 3.02 × 0.93 mm Fore-body 0.31 mm long. Oral sucker small, measuring 0.50 × 0.31 mm Acetabulum, in anterior half of the body measuring 0.62 × 0.56 mm. Sucker ratio 1 : 1.8. Pharynx contiguous. Oesophagus not visible. Ceca long and serpentine. Testes, Ovary not developed. Excretory vesicle not observed.

From Saeed & Bilqees, 1992

ISOPARORCHIS

Elongoparorchis Rao, 1961

Diagnosis of *Elongoparorchis pneumatis* ~~gen. et sp. nov.~~ RAO, 1961

Isoparorchiidae with foliate translucent light brown body. The subterminal oral sucker slightly smaller than the acetabulum. Genital pore median close behind the oral sucker. Muscular pharynx followed by a glandular stomach leading into sinuous caeca reaching the posterior end. Testes postero-lateral to acetabulum, elongated, sinuous, cylindrical or arcuate with dilatations. Ovary branched with lobulated club shaped arms situated on the left side. Vitellaria in two groups, each group with three or four radiating lobulated arms situated posterior to the ovary and the Mehlis's gland complex in the posterior region of the body. Receptaculum seminis large, on left side. Uterus extensively coiled occupying the pre-ovarian region. Hermaphroditic sac conspicuous. Eggs small. Excretory stem sigmoid with a posterior vesicle. Parasitic in the air-bladder of marine fishes.

Elongoparorchis pneumatis ~~gen. et sp. nov.~~ RAO, 1961

In the course of investigations on the helminth parasites of marine fishes of the coastal waters at Waltair (India) it was observed that an apparently hitherto undescribed trematode occurred in the air-bladder of the catfish, *Arius jella*. Previous records of air-bladder trematodes are those of Southwell (1913) who reported the genus *Isoparorchis* from several freshwater fishes and *Cylindrorchis tenuicutis* from the marine fish, *Tetrodon stellatus*, at Ceylon. The present fluke whilst bearing a very superficial resemblance to *Cylindrorchis* is closely related to *Isoparorchis* but it differs from the latter in some important respects which appear to have generic value. For this reason a new genus and species *Elongoparorchis pneumatis* is proposed for the present form from *Arius jella*.

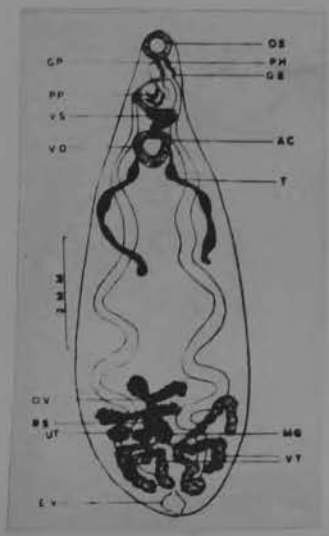
In the general morphology and anatomy, especially the presence of a glandular stomach, long serpentine caeca, postero-lateral position of the symmetrically arranged testes and the position and arrangement of the female reproductive apparatus, the present trematode resembles the genus *Isoparorchis* Southwell, 1913, and the characters suggest that it should belong to the family Isoparorchiidae Poche, 1926, (see Yamaguti, 1958). But as it becomes obvious from the table of characters given below the present trematode to which the new generic name *Elongoparorchis* is given, appreciably differs from the genus *Isoparorchis*.

Isoparorchis Southwell, 1913	*Elongoparorchis* ~~n.g.~~ RAO, 1961
1. Testes round.	1. Testes elongated sinuous and cylindrical or arcuate with dilatations.
2. Ovary band shaped.	2. Ovary branched with club shaped lobulated arms.
3. Each group of vitellaria dendritic.	3. Each group of vitellaria with radiating lobulated arms.

RAO, 1961

Elongoparorchis pneumatis gen. et sp. nov. (Trematoda) from the Air-bladder of the Marine Catfish, *Arius jella* (Val.)

In life the translucent worms appear light brown in colour showing slight movements on the silvery white wall of the air-bladder. Brown pigment trails presumably of haematin are often left on the wall, hence the presence or absence of the parasites could immediately be ascertained on opening the bladder. A full grown specimen (Fig. 1) has the following measurements. Length is 9·2 mm. with greatest breadth of 3·5 mm. The subterminal oral sucker (OS) is 0·6 mm. in diameter; the acetabulum (AC) situated 2 mm. from the anterior end, is 0·77 mm. across. The genital pore is situated immediately behind the oral sucker. The pharynx (PH) measuring 0·2 × 0·17 mm. opens into a thick walled glandular stomach (GS) which opens into the intestinal caeca. The caeca run in a sinuous course and reach the posterior end. The testes which lie dorsal to the intestinal caeca are symmetrical and situated postero-lateral to the acetabulum. Each testis (T) is elongated, arcuate with dilatations or may be sinuous and cylindrical. The vasa deferentia meet in a vesicula seminalis (VS) followed by a pars prostatica (PP) and the ejaculatory duct which finally opens into a hermaphroditic sac. The female reproductive apparatus is situated in the posterior region of the body. The ovary (OV) lies on the left side and consists of four club-shaped lobulated arms. The short oviduct is united by a duct from the conspicuous receptaculum seminis (RS). The vitellaria (VT) are arranged in two groups of three lobulated radiating branches on the right and four on the left, situated behind the ovary and the Mehlis's gland complex. The vitelline ducts from the two groups unite and the median duct opens into the ootype near the junction of the oviduct and the duct from the receptaculum seminis. The thick walled ootype is surrounded by prominent Mehlis's gland cells (MG). The ootype continues into the uterus which ascends up following a winding course occupying the preovarian region and finally opening into the hermaphroditic sac. Eggs are small, measuring 13·2 × 6·6 μ. Excretory stem is sigmoid with a posterior vesicle.



Host : *Arius jella* (Val.)
Habitat : Air-bladder.
Locality : Waltair, India.

ELONGOPARORCHIS

Pelorohelminthidae ~~n. fam.~~

FISCHTHAL AND THOMAS, 1968

DIAGNOSIS: Hemiuroidea. Body large; tegument thick. Oral sucker subterminal ventral, followed directly by pharynx and esophagus. Ceca winding to near posterior extremity. Acetabulum in anterior body third. Testes two, symmetrical, serpentine, postacetabular. Seminal vesicle, pars prostatica and ejaculatory duct present. Genital cone in three parts: proximal hermaphroditic chamber into which ejaculatory duct and metraterm project and open independently; middle hermaphroditic vesicle; distal muscular part projecting into muscular genital atrium. Genital pore median to slightly submedian, between oral sucker and cecal bifurcation. Ovary round, posttesticular. Vitellaria dendritic, multilobed, between testes and cecal ends, inter- and extracecal. Uterus postacetabular, between acetabulum and cecal ends, inter- and extracecal. Metraterm of two muscular parts. Eggs small, numerous. Excretory bladder long, sinuous, part near excretory pore muscular. Includes only one genus, *Pelorohelmus* Fischthal and Kuntz, 1964.

With the presence of three species in the genus, we believe that the erection of a new family for them is warranted. Therefore, we are raising the subfamily to family status.

~~Hemiuridae~~
Isoparorchidae

Pelorohelminthinae ~~subfam. n.~~ FISCHTHAL AND KUNTZ, 1964

Diagnosis

Hemiuroidea. Body large, cuticle thick. Oral sucker subterminal, followed directly by pharynx and esophagus. Ceca winding to posterior extremity. Acetabulum in anterior body third. Testes postacetabular, tandem. Seminal vesicle, pars prostatica, prostate gland cells, and muscular ejaculatory duct present. Genital cone in three parts: proximal hermaphroditic chamber into which ejaculatory duct and metraterm project and open independently; middle hermaphroditic vesicle; distal muscular portion projecting into muscular genital atrium. Genital pore median, ventral to pharynx. Ovary round, in tandem with testes. Vitellaria dendritic, multilobed, between posterior testis and cecal ends, inter- and extracecal. Uterus postacetabular, inter- and extracecal. Metraterm of two muscular portions. Eggs very small, numerous.

We propose establishing a new subfamily Pelorohelminthinae for the new genus herein described.

~~Hemiuridae~~
Isoparorchidae

Superfamily Hemiuroidea

Pelorahelmins ~~gen. n.~~ FISCHTHAL AND KUNTZ, 1964

Diagnosis

Hemiuroidea. Body large, cuticle thick, unarmed. Preoral body present. Oral sucker subterminal ventral. Prepharynx absent. Pharynx large, partly overlapping oral sucker. Esophagus present. Ceca ending to posterior extremity. Acetabulum in anterior body third. Testes two, postacetabular, tandem. Seminal vesicle at acetabular level. Pars prostatica surrounded by prostate gland cells. Ejaculatory duct muscular, eversible. Genital cone in three parts: proximal hermaphroditic chamber into which ejaculatory duct and metraterm project and open independently; middle hermaphroditic vesicle; distal very muscular portion projecting into genital atrium. Genital atrium large, with inner haldevike arrangement of circular muscle bundles and outer similarly arranged longitudinal muscles extending posteriorly beyond genital cone. Genital pore median, ventral to pharynx. Ovary round, in tandem with and considerably posterior to testes. Mehlis' gland well developed. Vitellaria dendritic, multilobed, inter- and extracecal, extending across body in posttesticular space. Uterus postacetabular, inter- and extracecal. Metraterm bipartite, distal part more muscular, surrounded by gland cells. Eggs very small, numerous. Parasitic in intestine of marine fish sometimes found in fresh water.

~~Hemiuridae~~
Isoparorchidae

Pelorohelmins palawanensis ~~sp. n.~~ FISCHTHAL AND KUNTZ, 1964

(Figs. 5 and 6)

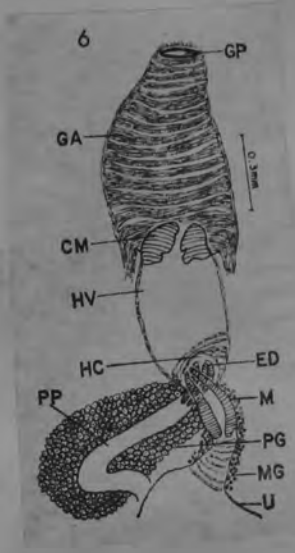
Host: *Gazza minuta* (Bloch) (Leiognathidae).
Habitat: Small intestine.
Locality: Puerto Princesa, Palawan Island, Philippines.
Date: 19 May 1962.
Holotype: USNM Helm. Coll. No. 60181.

Diagnosis (based on one specimen)

Body very large, 14,322 by 6,903; cuticle thick, unarmed; forebody slightly tapered, hindbody wide and bluntly rounded. Preoral body 77 long; forebody 3,452, hindbody 9,397, forebody to hindbody ratio 1 : 2.72. Oral sucker subterminal, ventral, 1,074 by 1,511; acetabulum 1,473 by 1,534, aperture round, in anterior body third; sucker length ratio 1 : 1.37; oral sucker to acetabulum 2,301. Prepharynx absent; pharynx 560 by 675, anterior half overlapping oral sucker dorsally; esophagus 313 long, bifurcation dorsal to posterior end of genital atrium; bifurcation to acetabulum 1,849; ceca winding to near posterior extremity, tips overlapping slightly. Excretory pore posterodorsal, surrounded by large sphincter muscle, 307 from posterior extremity.

Testes two, postacetabular, dextral, tandem, tadpole shaped with "tail" extending from right side along posterior of "body"; body of anterior testis 1,174 by 2,263, of posterior testis 890 by 1,779; acetabulum to anterior testis 629, to posterior testis 2,302. Vas efferens arising from anterodorsal region of body of each testis, joining anterior to testes to form broad vas deferens entering seminal vesicle. Seminal vesicle large, saccular, dextral to acetabulum, ventral to cecum; preacetabularly vesicle tubular, winding, intercecal, dextral to uterus. Pars prostatica tubular, with proximal loop, surrounded by thick layer of prostate gland cells. Ejaculatory duct short, very muscular, partly inverted into pars prostatica. Genital cone (Fig. 6) considerably modified into three parts: proximal part round, muscular hermaphroditic chamber 184 in diameter into which ejaculatory duct and metraterm project and open independently; middle part large, elongate, thinly muscular, sperm-filled hermaphroditic vesicle 598 by 384; and distal part very muscular, sphincter-like portion 156 by 316, projecting into genital atrium. Genital atrium large, 821 by 499, muscular, with inner ladderlike arrangement of strong circular muscle bundles and outer, more widely spaced, similarly arranged, longitudinal muscles, some of circular muscle fibers join with longitudinal fibers and proceed posteriorly beyond genital cone. Genital pore a transverse slit, median, prebifurcal, ventral to posterior portion of pharynx, 138 from oral sucker.

Ovary 759 by 775, round, dextral, intercecal, in tandem with testes, 2,263 posttesticular, postovarian space 3,183. Laurer's canal not seen. Mehlis' gland well developed, 331 sinistral to ovary. Vitellaria dendritic, with multilobed branches, inter- and extracecal, surrounding ovary and ootype complex, mostly ventral to ceca, extending from 365 posttesticular to cecal ends, three yolk ducts entering ootype complex. Uterus coiled in hindbody from ovarian level to acetabulum, mostly ventral to ceca and vitellaria, ascending dorsal to acetabulum; metraterm of two muscular portions, distal (283 by 162) more muscular than proximal (239 by 110), entering hermaphroditic chamber ventral to ejaculatory duct, gland cells surrounding metraterm. Eggs small, numerous, 10 measuring 13 to 16 by 10 to 13.



★ CORRECTION

In light of the description of *Pelorohelmins moniliovatus* (Freitas and Kohn 1967) n. comb., and *P. ghanensis*, we have reexamined the type species (USNM Helm. Coll. No. 60181), and find that the testes in the latter are symmetrical, narrow, much longitudinally elongate, and serpentine (Fig. 11) rather than tandem and dextral as originally described. The so-called "tandem testes" actually represents the right testis alone; a vas efferens was observed emerging from the anterior end of this testis, and was traced anteriorly to the acetabulum. Also, the seminal vesicle in the type species is preacetabular rather than being dextral to the acetabulum as originally described. The generic and subfamily diagnoses given by Fischthal and Kuntz (1964) need to be emended to state: Testes two, postacetabular, symmetrical, longitudinally elongate, serpentine. Immediately following, in the generic diagnosis only, it should state: Seminal vesicle extending anteriorly from acetabulum, bipartite.

FROM FISCHTHAL AND THOMAS, 1968

Discussion. The generic name *Pelorohelmins* (G. *pelorios*, monstrous) refers to the large size of the trematode. *Pelorohelmins* differs from all hemiurid genera in the morphology of its genital cone. It could not be fitted into any hemiurid family by using the keys given by Skrjabin and Guschanskaja (1960) and Mehra (1962). It resembles Isoparorchiidae Poche, 1926, in the structure and distribution of the vitellaria, and the cecal and uterine windings; examination of two specimens of *Isoparorchis hypselobagri* (Billet, 1898) Odhner, 1927 (USNM Helm. Coll. No. 51674) also indicated a basic similarity in structure of the genital atrium. Isoparorchiidae differs further in possessing a vermiform ovary, symmetrical testis, and posthifureal genital pore. *Pelorohelmins* resembles Sclerodistomidae Dollfus, 1932, in the form of the ovary; the latter family differs further in having a prominent acetabulum, tubular vitellaria in lateral fields, intercecal uterus, symmetrical or slightly diagonal testes, and genital pore at the cecal bifurcation or postbifureal.

FISCHTHAL AND THOMAS, 1968

Pelorohelmins ghanensis ~~n. sp.~~
(Figs. 9, 10)

HOST: *Arius latiscutatus* Günther, sea catfish (Ariidae).

HABITAT: Swim bladder.

LOCALITY: Téma, Ghana.

DATE: 17 December 1964.

SPECIMENS: USNM Helm. Coll. No. 63189 (holotype); No. 63190 (paratype).

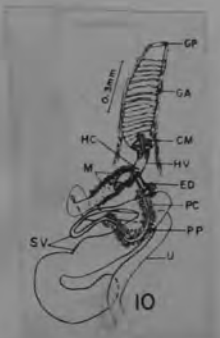
DIAGNOSIS (based on one adult worm, one young adult just starting egg production, and two immature specimens; adult measured): Body 11,015 by 4,370; tegument thick, unarmed. Hindbody wide and bluntly rounded at extremity, forebody tapering slightly. Forebody 1,895 long, hindbody 8,285, forebody to hindbody ratio 1 : 4.37. Preoral lobe present. Oral sucker subterminal ventral, 580 by 667; acetabulum 975 by 798, center at about level of anterior one-fifth of body length; sucker length ratio 1 : 1.68 (1 : 1.30 in young adult measuring 6,020 in total body length). Prepharynx lacking; pharynx 287 by 353, anterior three-fifths overlapping oral sucker dorsally; esophagus 166 long (contracted anteriorly); cecal bifurcation 1,012 preacetabular, dorsal to level of anterior one-third of genital atrium; ceca conspicuously cell-lined, winding to within 897 of posterior extremity (closer to latter in other specimens).

Testes two, symmetrical, narrow, much longitudinally elongate, serpentine, anteriormost margin posterolateral to acetabulum, mainly extracecal; right testis 3,465 in longitudinal extent, varying in width from 130–498; left testis 2,990 in longitudinal extent, varying in width from 115–445. Vasa efferentia long, emerging from anterior margin of each testis. Seminal vesicle large, bipartite; proximal part long, relatively thin-walled, winding anterodextral to acetabulum, inflated with sperm; distal part much shorter, thick-walled, muscular, tubular, with single dextral loop. Pars prostatica thick-walled, muscular, cell-lined, sinuous, much shorter than seminal vesicle, distal part enlarged into a chamber, entirely surrounded by thick layer of prostate cells, sinistral to metraterm. Ejaculatory duct short, very muscular, with much enlarged muscular sphincters at each end, posterior sphincter projecting into chamber of pars prostatica, anterior sphincter projecting into proximal chamber of genital cone. Genital cone 298 by 74, considerably modified into three parts: proximal part round, muscular hermaphroditic chamber 74 in diameter into which ejaculatory duct and metraterm open independently; middle part 106 by 66, an elongate, thick-walled, muscular hermaphroditic vesicle; distal part a large, very muscular sphincter, 158 by 121, projecting considerably into genital atrium. Latter large, elongate, 628 by 175, muscular, with inner ladderlike arrangement of strong circular muscle bundles which are relatively widely spaced from one another, and outer thick layer of longitudinal muscles; entire atrium surrounded by thick layer of longitudinal muscle fibers lying free in parenchyma, fibers proceed posteriorly beyond genital cone. Genital pore a narrow, transverse slit, median slightly submedian, prebifurcal, ventral to anterior part of esophagus, 107 from oral sucker.

Ovary 324 by 505, smooth, median, intercecal, 3,298 posttesticular, postovarian space, 588 long. Oviduct from ventral surface of ovary, enlarging into vesicle before narrowing and becoming surrounded by Mehlis' gland. Ootype well developed, juxtaposed posterosinistral to ovary, sinistral to ootype. Laurer's canal not seen. Vitellaria dendritic, with multibranched branches, inter- and extracecal, 1,755 posttesticular, three vitelline ducts entering ootype complex. Uterus coiled in hindbody from level of cecal ends to acetabulum, dorsal to ceca and vitellaria, ascending dorsal to acetabulum; metraterm dextral to pars prostatica, composed of two muscular parts, distal 187 by 96, more muscular than proximal, a large, very muscular sphincter separates proximal and distal parts and projects into latter; few gland cells surrounding metraterm. Eggs small, numerous, 13 measuring 23–27 by 13–17.

Excretory bladder long, sinuous, thick-walled, cellular except for short, muscular part closest to excretory pore, short, narrow duct connecting bladder to subterminal dorsal excretory pore; arms uniting dorsally between anterior part of esophagus and pharynx.

DISCUSSION: The type species of the genus *P. palawanensis*, was described by Fischthal and Kuntz (1964) from a single specimen from the small intestine of *Gazza minuta* (Bloch) (Leiognathidae) from Palawan Island, Philippines. Without placing it in a family but within the superfamily Hemiuroidea, they created the subfamily Pelorohelminthinae for the genus. Freitas and Kohn (1967) described *Dollfustravassosius moniliovatus* n. gen., n. sp. from the swim bladder of *Arius* (= *Tachysurus*) *grandicassis* Valenciennes (Ariidae) from Marambaia Island, Brazil, and placed it in a new subfamily Dollfustravassosiinae within the family Isoparorchiidae Poche, 1926. We declare *Dollfustravassosius* and Dollfustravassosiinae synonyms of *Pelorohelmins* and Pelorohelminthinae, respectively. For reasons discussed by Fischthal and Kuntz (1964) excluding the reference to symmetrical testes the genus can not be placed in the family Isoparorchiidae.



P. ghanensis differs from *P. palaucanensis* in having larger eggs, and the Mehlis' gland next to or in contact with the ovary rather than relatively far removed; further, in the former the oötype lies between the ovary and Mehlis' gland, the secretions of the latter flowing dextrally into the oötype, whereas in the latter the Mehlis' gland lies between the ovary and oötype, its secretions flowing sinistrally into the oötype. *P. ghanensis* and *P. palaucanensis* differ from *P. moniliovatus* in having the eggs haphazardly arranged in the uterus rather than moniliform, the genital atrium (as defined by us) elongate rather than globular and appearing as a genital bulb, and the excretory pore subterminal dorsal rather than terminal. *P. palaucanensis* differs further from *P. moniliovatus* in having the Mehlis' gland relatively far removed from the ovary rather than next to or in contact with the latter. The structural details of the terminal genitalia in *P. moniliovatus* either differ significantly from the other two species or, as is probable, are not presented.

PELOROHELMINS

TEIXEIRA DE FREITAS AND KOHN, 1967

DOLLFUSTRAVASSOSIUS ~~gen. n.~~

Dollfustravassosiinae.

Corps avec l'aspect fascioliforme. Cuticule fine et lisse. Ventouse orale sous-terminale. Acétabulum pré-équatorial. Pharynx présent. Œsophage court. Caeca intestinaux sinueux. Pore génital ventral à l'œsophage. Atrium génital (ducte hermaphrodite) présent, allongé. Poche du cirre absente. Cirre petit. Région prostatique courte. Vésicule séminale bien développée, sinueuse, pré-acétabulaire. Testicules allongés, post-acétabulaires, latéraux, pré-ovariens, dans les aires extracaecales, caecales, et intercaecale. Ovaire plus ou moins arrondi, rapproché de l'extrémité postérieure du corps, intercaecale. Glande de Mehlis présente, près de l'ovaire. Receptacle séminal féminin (spermathèque) et canal de Laurer non observés. Utérus pré-ovarien, intercaecal, caecal et extracaecal. Œufs operculés, petits, accolés en filaments moniliformes. Vitellogènes constitués par groupes de follicules en grappe, intercaecaux, caecaux et extracaecaux ou, trépassant antérieurement et postérieurement la zone de l'ovaire, pore excréteur terminal. Vessie excrétrice en forme d'Y, avec des branches sinueuses qui s'anastomosent au niveau du pharynx. Parasites des poissons marins.

ESPÈCE TYPE : *D. moniliovatus* sp. n.

TEIXEIRA DE FREITAS AND KOHN, 1967

DOLLFUSTRAVASSOSIINAE ~~subfam. n.~~

Isoparorchiidae.

Trématodes grands ; ventouse orale, pharynx et acétabulum bien développés ; caeca intestinaux sinueux ; pore génital œsophagien ; atrium génital (ducte hermaphrodite) présent ; poche du cirre absente ; prostate courte; vésicule séminale développée; testicules allongés, post-acétabulaires et latéraux ; ovaire intercaecal, post-testiculaire ; utérus pré-ovarien ; œufs operculés, accolés en filaments moniliformes ; vitellogènes en groupes de follicules en grappe, au niveau de la région de l'ovaire ; vessie excrétrice en Y, avec des branches anastomosées antérieurement. Parasites des poissons marins.

GENRE TYPE : ***DOLLFUSTRAVASSOSIUS*** gen. n.

Isoparorchiidae

TEIXEIRA DE FREITAS AND KOHN, 1967

DOLLFUSTRAVASSOSIUS MONILIOVATUS ~~sp. n.~~

Trématodes d'aspect fascioliforme, avec une partie antérieure étroite et une partie postérieure plus large et plus longue, atténuée à son extrémité ; la cuticule est fine et lisse. Taille : 19,66 à 32,66 mm de long sur 7,06 à 10,47 mm de large. La ventouse orale est sous-terminale, dépassée antérieurement par la paroi du corps ; elle a de 0,70 à 1,33 mm de diamètre longitudinal sur 0,74 à 1,53 mm de diamètre transversal. La ventouse ventrale ou acetabulum est située dans la partie antérieure du corps ; son diamètre longitudinal est de 0,96 à 2,47 mm et son diamètre transversal de 0,94 à 2,47 mm. Le rapport entre la ventouse orale et l'acetabulum est variable de 1 : 1,53 à 1 : 1,72. Il n'y a pas de prépharynx. Le pharynx est musculeux, long de 0,32 à 0,60 mm et large de 0,36 à 0,69 mm. L'œsophage est court et large. Les caeca intestinaux sont sinueux, dirigés postérieurement jusqu'à l'extrémité du corps. Le pore génital est ventral à l'œsophage. L'atrium génital est tubulaire, plus ou moins cylindrique, long de 0,86 à 1,53 mm et large de 0,10 à 0,27 mm ; sa portion antérieure, longue de 0,28 à 0,35 mm et large de 0,24 à 0,47 mm, est globuleuse et fortement musculeuse, ayant l'aspect d'un bulbe génital. Il n'y a pas de poche du cirre. Un petit cirre est présent ; il pénètre dans l'atrium génital à une distance de 0,33 à 0,67 mm de son extrémité proximale. La région prostatique est relativement courte. La vessie séminale est longue et sinueuse, atteignant le bord antérieur de la ventouse ventrale. Le canal déférent est long et situé dans l'aire acétabulaire. Les canaux efférents sont plus courts. Les deux testicules sont allongés et post-acétabulaires, présentant ou non des dilatations à leurs extrémités et une dilatation globuleuse, saillante, dans le tiers moyen de sa longueur ; situés latéralement, les testicules occupent les aires intercaecale,

FIG. 1. — *Dollfustravassosius moniliovatus* gen. n., sp. n. : l'exemplaire type

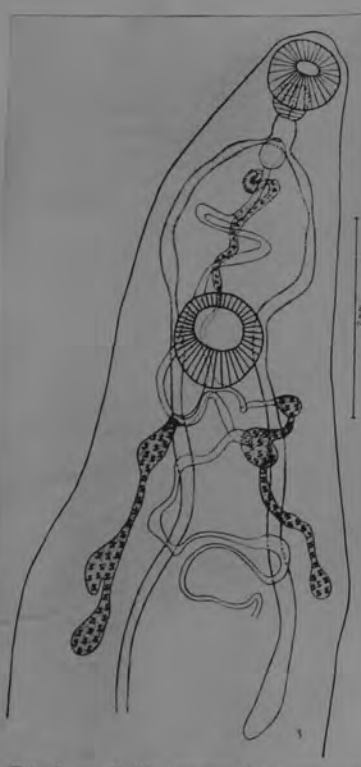


FIG. 3. — *Dollfustravassosius moniliovatus* gen. n., sp. n. : Paratype n° 30.082 *a*, incomplet, montrant tout l'appareil génital masculin

FIG. 4. — *Dollfustravassosius moniliovatus* gen. n., sp. n. : L'atrium génital, vagine et partie distale de l'appareil génital masculin du paratype n° 30.082 *b*

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caecales et extracaecales et mesurent 2,33 à 7,20 mm de long. L'ovaire est plus ou moins arrondi, intercaecal, rapproché de l'extrémité postérieure du corps, et mesure 0,40 à 1,53 mm de long sur 0,27 à 1,67 mm de large. La glande de Mehlis, longue de 0,48 à 0,53 mm et large de 0,32 à 0,45 mm, est située près de l'ovaire. Le receptacle séminal féminin (spermathèque) et le canal de Laurer n'ont pas été observés. Les anses utérines sont nombreuses et pré-ovariennes, occupant les aires intercaecale, caecales et extracaecales. Le vagin est long et sinueux, pré-acétabulaire, et s'ouvre à l'extrémité proximale de l'atrium génital. Les œufs, de coloration jaunâtre, sont operculés et se présentent accolés les uns aux autres par leurs extrémités, formant des filaments moniliformes de dimensions variables ; ils mesurent 0,015 à 0,024 mm de long sur 0,012 à 0,020 mm de large. Les vitellogènes sont constitués par des follicules disposés en grappes, occupant les aires intercaecale, caecales et extracaecales et outrepassant antérieurement et postérieurement la zone de l'ovaire. Le pore excréteur est terminal. La vessie excrétrice est forte et dilatée distalement ; elle a la forme d'un Y et ses branches sont sinueuses et s'anastomosent au niveau du pharynx.

HABITAT : Vessie natatoire de *Tachysurus grandicassis* (Val.). Marine catfish

PROVENANCE : Ile de Marambaia (Océan Atlantique). Etat de Rio de Janeiro, Brésil. TYPE n° 30.080 et PARATYPES n° 30.081 et 30.082 *a-c* dans la Collection Helminthologique de l'institut Oswaldo Cruz.

Discussion : *Dolfustravassosiinae* subfam. n. s'éloigne de la sous-famille *Isoparorchiinae* (Travassos, 1922) par la forme et par la situation des testicules, par la forme de l'ovaire et par l'aspect des œufs, disposés en filaments moniliformes.

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FIG. 5. — *Dollfustravassosius moniliovatus* gen. n., sp. n. : Région du corps où sont situés l'ovaire et les vitellogènes (même exemplaire de la figure antérieure)

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FIG. 6. — *Dollfustravassosius moniliovatus* gen. n., sp. n. : Treize œufs du même exemplaire de la figure 4, accolés, en filament moniliforme

FIG. 7. — *Dollfustravassosius moniliovatus* gen. n., sp. n. : Un œuf isolé du même exemplaire de la figure 4

Isoparorchiidae

Dollfustravassosius moniliovatus Freitas and Kohn, 1967

RESULTADOS

Diagnose — Dollfustravassosiinae: trematódeos grandes, de aspecto fascioliforme, com a região anterior destacada; cuticula lisa; comprimento de 20,2 (18,0 — 23,2) e largura de 8.4 (6,3 — 10,4). Ventosa oral subterminal, medindo 1,8 (1,6 — 1,9) de diâmetro longitudinal e 2,0 (1,7 — 2,2) de diâmetro transversal. Acetábulo localizado na parte anterior do corpo, medindo 1,8 (1,6 — 1,9) de diâmetro longitudinal e 1,9 (1,7 — 2,1) de diâmetro transversal. A relação entre a ventosa oral e o acetábulo é de 1:1 (0,9 — 1:1). A faringe é musculosa e pequena, medindo 0,5 (0,4 — 0,5) de comprimento e 0,63 (0,60 — 0,67) de largura. Esôfago muito curto. Os cecos intestinais são sinuosos, chegando quase à extremidade posterior do corpo. O poro genital está localizado junto ao esôfago. O átrio genital é tubular, medindo 1,17 (1,05 — 1,32) de comprimento e 0,14 (0,10 — 0,16) de largura máxima; sua porção anterior é globulosa e fortemente musculosa, medindo 0,43 (0,34 — 0,48) de comprimento e 0,34 (0,31 — 0,37) de largura. A bolsa do cirro está ausente; o cirro é pequeno e penetra no átrio genital à uma distância de 0,71 (0,63 — 0,84) de sua extremidade proximal. Região prostática curta; vesícula seminal longa e sinuosa. O canal deferente é longo e fino, estando localizado sob o acetábulo; os canais eferentes são curtos; os testículos são alongados e pós-acetabulares, mais dilatados nas extremidades distais e ocupam principalmente as áreas extracecais, medindo 5,68 (3,68 — 7,62) de comprimento. O ovário é mais ou menos arredondado, intercecal, localizado na porção distal do corpo, medindo 0,33 de diâmetro longitudinal e 0,23 de diâmetro transversal. A glândula de Mehlis é pré-ovariana. Não foi possível observar o canal de Laurer. As alças uterinas são pré-ovarianas e totalmente ascendentes, ocupando áreas intercecais, cecais e extracecais. A vagina é pré-acetabular e se abre na parte anterior do átrio genital. Os ovos são operculados e estão ligados uns aos outros, formando filamentos dispostos em cachos, apresentando-se em número variado e localizando-se nas áreas intercecais, cecais e extracecais. O poro excretor é terminal e está presente uma vesícula excretora bem desenvolvida e em forma de Y.

Habitat — Bexiga natatória de *Netuma barba* (Lacépède, 1803).

Proveniência — Rio Mampituba, Torres, RS, Brasil.

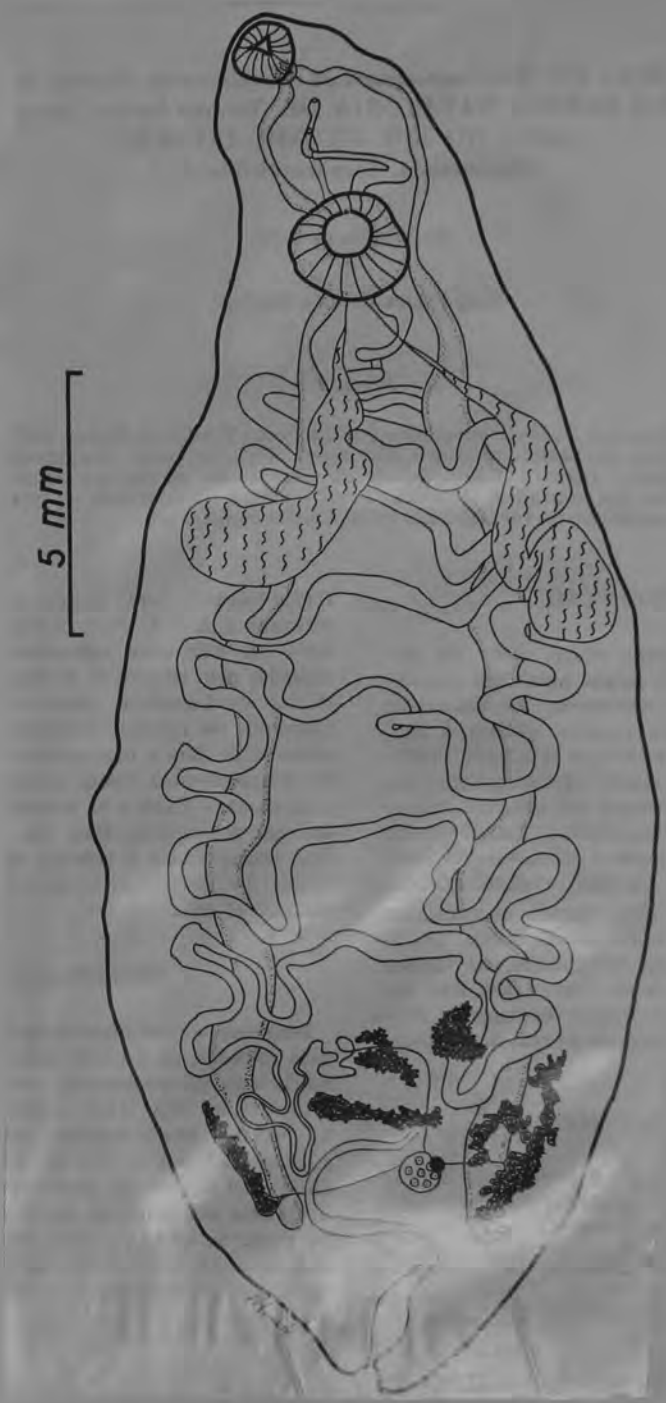

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TABELA 1

Intensidade de infestação individual de N. barba *por* D. moniliovatus

Hospedeiro N.º	1	2	3	4	5	6	7	8	9
N.º de Trematódeos	14	2	8	12	3	1	19	5	6

DISCUSSÃO

O número total de trematódeos, retirado de cada hospedeiro aparece na Tabela 1, onde se observa que a prevalência nos nove exemplares de bagre examinados foi da ordem de 100% e que a amplitude de variação foi de 1 a 19 helmintos. A intensidade média de infectação observada foi de 6,6 trematódeos por hospedeiro e o total de helmintos coletados foi de 70. Não é possível correlacionar os dados por nós obtidos, porque estes são os primeiros da literatura, relativamente à prevalência, intensidade média de infecção e à amplitude de variação das intensidades de infecção de helmintos desta espécie. FREITAS & KOHN (1967), apenas descreveram a espécie. Observando-se as medidas dos nossos exemplares e a prevalência de 100%, pode-se depreender que estes peixes viviam em uma mesma área, de modo que devem ter sido expostos às metacercárias do trematódeo, em uma mesma época.

From Amato, 1974

DOLLFUSTRAVASSOSIUS